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CONGENITAL CYSTS OF THE NECK IN CHILDREN*

R. L. PAYNE, M.D., F.A.C.S.

Surgeon to St. Vincent's Hospital

NORFOLK, VA.

THE fascinating side of neck cysts in children is their embryological origin; and one cannot grasp the significance of these lesions unless a study is made of the fetal anatomy. These cysts are always surgical conditions and their cure is entirely dependent on a complete knowledge of the embryonal structures from which they are derived. There are six distinct types of neck cysts, but the parasitic, the inclusion dermoid and thyroid cysts are so rare in children that it does not seem practical at this time to consider in detail any except the hygroma, the thyroglossal and the branchial type.

HYGROMA

This type is often spoken of as a lymphocele and is always of lymphatic origin arising from the jugular sinus, a fetal bud developing about the third month of embryonal life. Lymphatic development begins at about the sixth week and the jugular and subclavian lymph sacs are well developed in a 30 mm. embryo. They are found lying between the primitive jugular and subclavian veins and connect directly with these structures. In the ordinary course of events these embryonal structures become obliterated by the growth of reticulated connective tissue and the formation of lymph follicles and gland nodes, both taking their origin from the endothelium lining the primary sacs. Sometimes structural faults occur in the developing embryo which result in a failure to obliterate all or a part of the jugular and subclavian lymph sacs and these remain to develop after birth into cystic tumors of the neck.

The jugular sinus extends from the base of the skull at the jugular foramen downward to the subclavian vicinity under the clavicle. Thus is explained the location of this tumor at any point from near the styloid process to the axillary space. Usually it is found in the lowest part of the posterior triangle and, strangely, is more common on the right side of the neck. I have seen but one on the left side and find one other reported by Lyle.

In children these cystic growths show as a soft, spongy tumor. They begin as a small mass remaining quiescent for months or years and then suddenly take on a rapid growth. A common history is that of trauma followed by an immediate and rapid enlargement of the mass, while infection and toxic absorption incident to the acute diseases of childhood is very commonly a factor exciting to sudden and increased growth. Thompson thinks this is due to an increased secretion of lymph

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from the endothelial cells and to a diminished permeability whereby secretion is ordinarily absorbed in the surrounding tissues. The clinical aspect is that of a painless, slowly growing tumor, soft and semi-fluctuating, with skin movable over the growth but the growth not movable on the underlying tissues (Winslow). With trauma or infection there follows a rapid increase in size. I once saw one of these begin to grow fast from infection following a diagnositc puncture by the attending physician. Needle puncture, under sterile precautions, is a valuable help in diagnosis but the needle should not be thrust into more than one area lest the trauma of puncture in numerous places serve to stimulate a rapid increase in tumor growth.

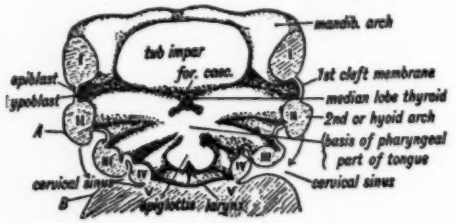

Fig. 1. A drawing taken from Keith's Anatomy showing the branchial arches and internal cleft spaces. (*After Thompson.*)

When the cyst is low on the neck, or of considerable size, it is seen to grow tense and hard when the child cries violently or makes any excessive respiratory efforts such as coughing or sneezing. On section these tumors are of delicate cobweb-like consistence, with large and small interspaces filled with lymph-like fluid. The spaces are lined with a poorly differential type of endothelial cell which can only be shown by fresh staining with silver nitrate immediately following removal of tumor. In the small early cysts the new loculi show only a clear fluid. The older cysts which have been traumatized or infected show thickened walls and a pale, pinkish, jelly-like exudate which promptly coagulates on exposure.

The surgical problem is usually a tedious dissection, for the processes of the cyst dip down between all the muscle planes, always beneath the deep cervical fascia and often extend from the styloid process above to the clavicle and pectoral muscles below. Rapid recurrence always follows incomplete removal and Dowd reports one recurrence in twenty-five days following the first incomplete operation. It has been my privilege to see four tumors of this type all of which were satisfactorily handled by surgical removal.

Thyroglossal Cysts

In this type the embryological origin is of tremendous importance, for upon the knowledge of these facts depends the successful surgical treatment. As the name implies, the origin of these cysts is intimately connected with the tongue and thyroid isthmus and upon this knowledge depends the surgical eradication of these tumors. Between the third and sixth week of the embryo the arches have all closed or disappeared and at this time a bud from the hypoblast grows downward from the base of the tongue at the point known as the foramen cecum passing through the pharyngeal portion of the tongue thence through the hyoid bone, or above or below this bone, and terminates to form the isthmus of the thyroid gland. Usually this tubal bud is obliterated, but sometimes

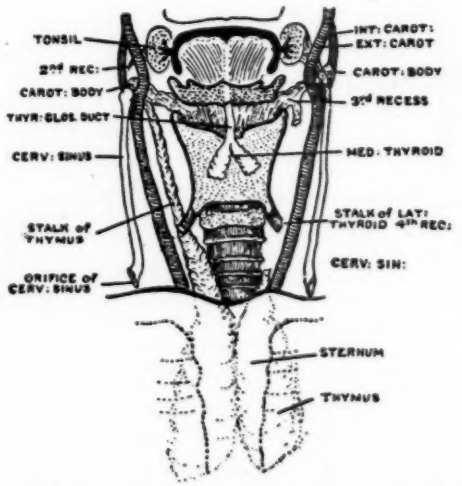

Fig. 2. A drawing from Keith's Anatomy showing the location and extent of the cervical sinus. (*After Thompson.*)

such is not the case and there then persists a tube extending part or all the way from the foramen cecum at the base of the tongue to the thyroid isthmus. This later develops into a cyst and its complete surgical removal depends on the amount of the original tube that remains patulous; occasionally the demonstrable cyst is all of the persistent embryological structure and surgical removal of this cyst will suffice to cure. Too often, however, the cyst is not all of the vestigial remains and a small tube, lined with a single layer of epithelium, runs back to the hyoid and often beyond the hyoid through the tongue to the foramen cecum. Operative failures are of course due to incomplete removal but the great problem for the surgeon is how to know when complete eradication has been accomplished.

Fig. 3. Photograph of Winslow's case showing hygroma extending from the clavicle downward into the axilla and onto the arm. (*By permission.*)

The persistent duct is usually too small for macroscopic demonstration and it is only by second and third operative attempts to cure that the surgeon realizes he must dissect the complete course of the embryological vestige. Injection of the cyst with an aniline dye has found favor with some surgeons but this measure has too often failed. The surgical cure of these cysts can therefore be divided into two varieties of operations: first, the conservative which attempts to remove only what is visible, and second, the radical which begins the dissection at the thyroid isthmus and passing up includes a small central piece of the hyoid bone and all of the vestigial tract up to the foramen cecum, thus extending through the floor of the mouth

Fig. 4.

Fig. 5.

Fig. 6.

Fig. 4. Sketch of author's case showing hygroma situated at the usual location between the clavicle and submaxillary region.

Fig. 5. Sketch of author's case showing the unusual location of a hygroma on the left side of the neck extending from the submaxillary region downward below the clavicle over the pectoral muscle.

Fig. 6. Drawing representing author's case of cervical sinus as cited in manuscript with location at about the midpoint of the left sternomastoid muscle along the internal border.

and the entire thickness of the tongue at its base. This dissection calls for the removal of the persisting central tubal bud or tract, the center of the hyoid bone, the fibrous raphé of the mylohyoid, geniohyoid and geniohyoglossus muscles together with the adjacent tissues of tongue around and including the foramen cecum.

Fig. 7.

Fig. 8.

Fig. 7. Sketch of drawing from a boy eleven years old showing a typical cervical cyst arising from the cervical sinus and situated high in the neck between the parotid gland and the thyroid cartilage.
Fig. 8. Drawing of a typical case of thyroglossal cyst with discharging fistula in the midline of the neck.

The recognition of this type of congenital cyst should be easy for it always occurs in the midline between the symphysis mentis and the thyroid cartilage. It should, however, be differentiated from ectopic thyroid tissue, enlarged submental gland, inclusion dermoids which are always found in the median line, lingual dermoids, submental cysts which develop from the cervical sinus and often called ranula, and lastly from the true cervical fistula which is of branchiogenic origin and always situated lateral to the midline along the anterior border of the sternomastoid muscle.

Then too, the thyroglossal cyst always contains as ticky mucus in contradistinction to the pale, coagulating type of lymph found in the hygroma; and if this sticky mucus is carefully examined with the microscope there will often be found epithelial cells. No cells are found in fluid aspirated from an hygroma. We have had eight cases of this type all of which have been cured by complete surgical removal.

Branchiogenetic Cysts

This form covers the commonly seen cysts in the neck grouped under the heading of ranula, submaxillary cyst and cervical cyst. That these cysts are embryo-

Fig. 9. Schematic drawing showing grossly the anatomical course of a thyroglossal cyst and tract. Note the fibrous connection with the thyroid cartilage and the extension of the tract upward through the middle of the hyoid bone and muscles of the tongue to the foramen cecum.

logical in origin has long been believed but no definite structural origin was worthy of acceptance until James E. Thompson advanced his theory that these types of cyst are all derived from embryological remains of the cervical sinus. Time will not permit the writer to give you any description of minute embryology relative to this structure, but quoting rather liberally from Thompson we may relate as follows:

At the fourth week of the embryo, the second arch grows downward and covers the third and fourth arches and touches the body wall behind the fifth arch. This growth is analogous to that forming the gill cover in fishes, thereby the mouths of the second, third and fourth cleft depressions are covered up and a space is shut off into which they open. This space is called the cervical sinus and extends from the tonsils or second cleft to almost any point on the front of the neck. This sinus is usually obliterated but when this does not occur a cyst or sinus may result. For a surgeon to know that a ranula may connect, through a persistent sinus, with the tonsils is highly important and that one of these cysts of branchiogenetic origin may be subject to fragmentation or isolation by muscular action, thus producing one or more cysts all arising from a mother cyst is really the crux of the problem relative to surgical cure. No satisfactory evidence has ever been advanced to prove that ranulas come from mucous glands in the floor of the mouth or from salivary glands; and agreeing with Thompson, the whole subject is tremendously clarified if we accept the following:

From the vestigial remains of the branchial clefts are derived the ranula, the submaxillary and deep cervical cysts; the primary cyst results from the persistance of the cervical sinus and this is often carried from the original position by the shifting of the muscles during the formation of the neck. By the same muscles, isolation or fragmentation occurs and parts of the mother cyst are carried backward by the palate muscles while part is carried into the submaxillary region and tongue by the migration of the muscles of the hypoglossal group.

It is quite common to see the persistent embryological structure show as a sinus or fistula discharging on the surface of the neck, but the distinctive feature is that the opening is always located along the anterior border of the mastoid muscle. It has been observed that this fistula first began to discharge following one of the acute infections such as measles or scarlet fever and under these conditions it is often confused with the sinus of a suppurating cervical gland. If we have a true branchiogenetic fistula, a fine probe can sometimes be passed quite high in the tract which is at once suggestive, and particularly instructive will be a microscopic study of the discharge which will often show epithelial cells, for all branchial cysts and fistulae are lined with epithelium.

I have seen several branchial cysts but only one cervical fistula, and in this one case cure was brought about by an incomplete operation. The tract was dissected out above the branching of the carotids and there become so small that it was thought best to sever the connection. The neck wound healed tightly and it is assumed that the remaining portion of the tract opened into the pharynx and thus drained to the point of least resistance. Congenital cysts of the neck offer an interesting problem to the pediatrician and while the diagnosis is not always easy I must confess to the feeling that the cure of these cysts presents a delicate and often difficult surgical undertaking.

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URETERAL STRICTURES

J. NORMENT BAKER, B.A., M.D., F.A.C.S.

MONTGOMERY, ALA.

THE path of the trail-blazer has ever been strewn with difficulties. Columbus and Daniel Boone are conspicuous examples in the physical world, Jefferson and Thomas Paine in the realm of government and statesmanship, of the hardships to be overcome when effort is made to run counter to current trend of thought.

Should the trail of the medical explorer lead into virgin soil, he finds that every point of advance has to be stoutly contended: on the one hand, against the fallacies of inherited tradition and, on the other, against the inherent quizzical bias of the medical mind, which demands absolute physical proof of every statement made or theory advanced.

Scarce two score years ago, Reginald Fitz blazed the trail to the right iliac fossa by his epoch-making observations bearing on the relation of peritonitis and diseased conditions of the appendix. Did these observations and the deductions based thereon, although true and sound and a thousand-fold fortified by subsequent knowledge, pass unchallenged by his contemporaries? Not a few, living and working today have been active participants in many of the skirmishes necessary to establish upon a firm basis some of the mooted questions of the surgery of the appendix. And yet, what commonplace things these are now, which were scarcely known, or believed in, forty years ago!

Through the ages, the ureter, occupying a modest seat behind the peritoneum, unstudied, untouched—save to have removed from its lumen obstructing stone concretions—has played the rôle of absolute passivity; that of connecting one organ with another, in much the same fashion as a cast-iron pipe links the toilet bowl with the sewer main. That the ureter is composed of living cells, clothed in the same raiment of mucosa, muscularis and serosa as other important ducts, and consequently subject to the same vicissitudes of infection and inflammation, seemed to make but feeble appeal to the student of pathology.

Just ten years ago, Hunner, of Baltimore, began his pioneer work in this hitherto untouched field, which in all propriety might be called the ureteral trail. Within this short time, despite the many cynical bolts which have been hurled against his work, by reason of his dogged persistence and incessant preachments, most of the underbrush has now been cleared and this path stands out, for those who will but seek, as clearly as the noon-day sun. For the earnest clinician, as well as for the unbiased urologist or gynecologist, ureteral stricture should be considered as a distinct pathological and clinical entity, always to be seriously reckoned with when seeking a proper solution of any of the vague diagnostic problems within the abdominal cavity.

The intention here is not to offer defense or apology for the workers in this field. None is needed; the proof of this statement is to be had both in the increasing number of urologists from whose eyes the scales are fast falling, and in the number of relieved and satisfied patients, which after all, constitutes the acid test of all clinical therapy.

The reasons for this tardiness in accepting ureteral lesions as frequent symptom-producing factors as well as important elements in the production of kidney affections are not far to seek. The pioneer work in this field has been done largely by men working in the female and with the simple Kelly cystoscope, both of which factors permit of easy and ready approach

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to the ureter with bougies and bulbed catheters of large caliber. Just as the smaller sized steel sounds introduced into the male urethra fail to detect narrowing and obstruction here, just so certainly may the No. 5 or No. 6 ureteral catheter fail to reveal appreciable narrowing within the ureteral lumen. Within the past few years, considerable change and modification has been made in the more complicated electrically lighted instruments, designed for use in both sexes, with the result that many workers who formerly were inclined to protest vigorously against the clinical entity of ureteral stricture are now reporting large series of cases in which this lesion is of frequent occurrence.

Rathbun, of Brooklyn, reporting recently a study of 739 cases from a general urologic clinic made a diagnosis of ureteral stricture on radiologic evidence alone, and exclusive of tuberculous kidneys (in which ureteral lesions practically always occur) in 85 cases, 44 of which were in males and 41 in females. The greater incidence of this lesion in the male in this series of cases is both interesting and illuminating. It clearly shows that the male by no means enjoys immunity from ureteral stricture, which will be demonstrated if only proper search is made.

One is almost certain to miss, in many vague abdominal cases, the proper diagnostic trail, unless both the frequency of this lesion, and its protean manifestations are constantly borne in mind. One rarely recognizes a thing about which one does not think or for which one does not seek. Consequently, until urologists learn to look for, and internists, surgeons and general practitioners are taught to think in terms of, ureteral obstructive lesions, this important field is likely to suffer neglect.

There are a few embryologic and anatomical facts that serve to explain some of the confusing symptoms to which lesions within the ureter may give rise.

Embryologically, the kidney has a double origin. The secreting or cortical portion is derived from the mesothelium: from the Wolffian duct is derived the mechanical or collecting part, consisting of the calyces and straight collecting tubules, the pelvis and ureter, as well as the vesical trigone and urethra. Anatomically, one is not accustomed to think of the ureter as being prolonged above into the kidney and below through the bladder as the trigone, and, to the outside world, as the urethra. Yet, embryologically it is one continuous tube, and it is well for the clinician to bear this fact constantly in mind.

Again, the innervation of the ureter is derived from the sympathetic system and is in intimate association with nerves supplying the kidney, bladder, ovaries, testes and practically all organs within both the abdominal and pelvic cavities. These simple facts serve as a basis of explanation for the frequency with which ureteral lesions may be confused with symptoms which seem to arise from other organs. The pain of ureteral stone reflected to bladder, testicle or penis is the common knowledge of all; by the same token, any ureteral lesion other than stone may be and often is, mirrored in bladder, urethra or one of the pelvic or abdominal organs. Vesical frequency or irritation no more connotes vesical inflammation than does nausea or vomiting indicate gastritis. The trained eye of the cystoscopist, upon viewing a practically normal urethra and bladder, at once turns to the tract above for an explanation of the vesical symptoms.

Recently a patient was seen who, for ten years, both day and night, had had intractable bladder symptoms. An exhaustive study of the entire urinary tract revealed no lesion other than a rather dense stricture of the right ureter. She experienced complete relief from proper treatment of this condition alone.

As to the pathology of ureteral stricture, much interesting material is gradually accumulating. Goldstein and Carson, in a recent study of 46 consecutive autopsies, found a 9 per cent incidence of ureteral stricture, all verified by microscopical study.

Hunner, in a recent personal communi-

cation, furnished the following facts from the exhaustive work done by Schreiber, of New York, in the Senkenberg Pathological Institute, connected with the Frankfort Hospital, in Frankfort, Germany. [See The American Journal of Surgery, this issue, page 55]: In a series of 100 consecutive, unselected autopsies, on 42 men, 37 women and 21 children, he found a 12 per cent incidence of ureteral stricture. Of this 12 per cent, Schreiber considers 5 per cent as of congenital origin; he found that the majority of ureteral strictures occur in the lower pelvic portion and are the result of local inflammatory disease in the pelvis, rather than of distal focal infections.

Hunner, on the contrary, has consistently clung to the conception that the ureteral lesion originates, most often, from remote foci of infection; that it is frequently laid down in childhood and is concurrent with a pyelitis or pyelonephritis; that the pyelitis cleared, the ureteral lesion lying dormant, ofttimes, for years, subsequently to be lighted anew by some intercurrent infection, or by pressure from without, as in the pyelitis of pregnancy.

The chagrining aftermaths which are likely to ensue when undue haste or lack of study has led to unnecessary attack upon appendix, reproductive, or other organs, have been pointed out by me in previous contributions on this subject; suffice it here to say that only by the most discriminating study are many of these mistakes to be avoided.

Accumulating experience has shown that ureteral strictures, in their response to treatment, behave much like narrowings encountered in other tubular structures within the body, such as the urethra or esophagus. That is to say, when recognized and treated in the earlier stages, prior to the formation of dense scar tissue, the results are both gratifying and permanent. In cases that have been allowed to drift for years, the treatment, of necessity, is more prolonged and, to insure proper drainage for the kidney above, should be repeated at varying intervals over a period of several years.

This factor of drainage must never be lost sight of; it is the essence of success in eradicating kidney infection. My present practice is, in the very old and very chronic case, to apply dilatation and lavage at intervals of ten days to two weeks, until the infection has disappeared; and, upon the completion of this preliminary treatment to insist that the patient return at regular intervals—two or three months—for ureteral dilatation. The andrologist, through long years of experience in dealing with urethral stricture has learned that only by periodic dilatation can such lesions be kept symptom-free, and it would seem but logical to apply the same reasoning to ureteral obstructions.

The following cases, briefly recited, together with the pyelographic findings, will serve to elucidate some of the interesting points of ureteral stricture work:

Case 1. Mrs. W. C. B., aged fifty-four, quartipara, was first seen May 25, 1924. About twenty-five years before she had several attacks of severe, left loin pain, with hematuria, the condition then being diagnosed as kidney stone, but no recollection is had of passing stones per urethram. Since that time has had, at irregular and varying intervals, many attacks of a similar nature, some of them so severe as to require morphine for relief.

Ten days prior to first examination she experienced one of her attacks, since which time she has been confined to bed and pain has been almost constant.

Catheterized Bladder Urine. Few pus cells, no red blood cells; trace of albumin.

Roentgenogram. No stones in bladder, or in either ureter or kidney.

Cystoscopy. Bladder and ureteral openings appeared practically normal. No. 6 catheter carrying 4½ mm. bulb 10 cm. from its tip, was passed into the left ureter, where bulb "hangs" in tight area about 3 cm. above bladder and cannot be made to pass on further. Pelvic capacity 30 c.c. The urine from left kidney shows: Pus, 1 plus; few red blood cells.

Pyelogram. Dilated renal pelvis and upper ureter and two strictured areas: one near the

pevic brim and one just above the bladder (Figs. 1 and 2).

At subsequent treatments, the lower obstruction was dilated to 5 mm. but this bulb could never be passed through the upper stricture. Following these dilatations complete relief was enjoyed for one and one-half years when, following a long motor trip (a frequent aggravator of ureteral lesions), the patient experienced a return of the acute symptoms. During this attack, not even a filiform bougie

Fig. 1.

could be coaxed through the lower obstruction; six days later, after subsidence of the acute condition, a No. 6 catheter was passed all the way to the kidney and two weeks later, a No. 8 catheter armed with 4½ mm. bulb got by both obstructions. The urine from the left kidney is now pus-free and the patient is completely relieved of all symptoms.

This case presents several interesting features: the great length of time over which the lesion has persisted; the irregular periodicity of acute attacks, mimicking stone; the prompt disappearance of the overhead infection following the establishment of free drainage; and the necessity of persistence in treatment in order to keep the lumen patent.

Case II. Mrs. T. R. B., aged thirty, began to have trouble with the bladder ten years ago, voiding every one or two hours by day and three or four times by night. In addition, had attacks every two or three weeks in which the vesical irritability was marked and the desire to void constant. For the past year has been

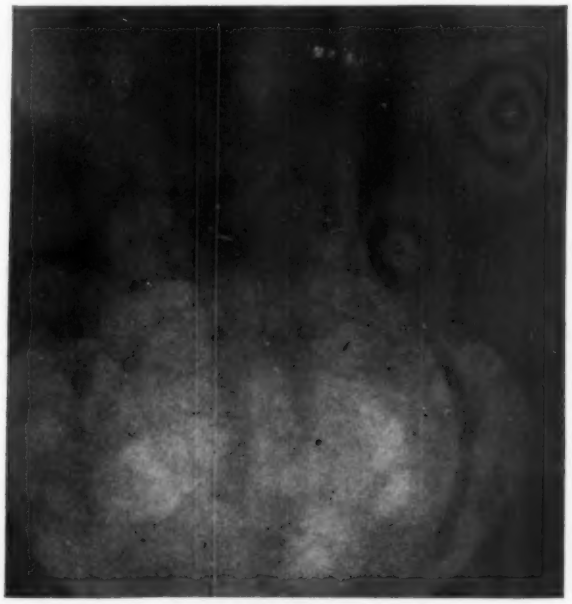

Fig. 2.

under the care of an internist, with no perceptible improvement.

Physical Examination. Right kidney tender, somewhat enlarged and slightly movable, with marked tenderness over the ureter at the pelvic brim. Left kidney negative.

Roentgenograms. Negative for stone.

Pyelogram. A rather small pelvis and three calyces with no deformity, but arranged in daffodil-like fashion; in the ureter a definite narrowing at the point of hang of bulb at pelvic brim (Fig. 3).

Cystoscopy. Bladder reveals no evidence of tuberculosis or ulcer, but a congested trigone and a small pouting right ureteral orifice; No. 8 catheter with 4⅓ mm. bulb passes with difficulty and reveals, on removal, tight hang of bulb at pelvic brim. Pelvic capacity 5 c.c.

Catheterized bladder urine: few pus cells; no red cells; no albumin. Urine from right kidney: few pus cells; few red cells.

The relief afforded by the treatment of the stricture alone, without the addition of any other therapy, was immediate and pronounced and serves well to illustrate the point made above that ureteral lesions frequently reflect their distress signals into the bladder.

Case III. Mrs. W. H. B., aged thirty-three, unipara. Two weeks after the birth of her first and only child, eight years ago, she had chills, fever and cystitis; since that time she had suffered with constant pain in the left loin and along the ureter. Six years ago was operated upon for appendicitis and removal of right ovary without relief. When first seen she was having a severe attack of left loin pain simulating renal colic with the history of having had many similar attacks during the preceding three or four years.

Fig. 3.

Physical Examination. Negative except for marked tenderness over the left kidney and over the ureter at the crossing of the pelvic brim. The urine showed only an occasional pus cell, no red cells.

Roentgenogram. Negative for stone.

Cystoscopy. Bladder normal; No. 7 catheter with 4 mm. bulb located definite obstruction 4 cm. above bladder.

Pyelogram. Fairly normal in outline with capacity of 5 c.c.; lower ureter showed definite stricture at the point of hang of the bulb, 4 cm. above bladder (Fig. 4).

Prompt relief was had from four dilatations of the stricture.

Fig. 4.

Case IV. Mrs. J. G. S., aged fifty-four, sextipara. First seen November, 1922. For sixteen years had had continuous trouble with the left side and loin. She had many acute attacks of severe pain with bleeding and for three years has been almost an invalid because of their severity and frequency. The symptoms point strongly to either stone, tumor or tuberculosis.

Physical Examination. Left kidney somewhat enlarged, lower pole palpable and tender, with tenderness along entire course of ureter. Right kidney negative. Abdominal walls much relaxed and flabby. Bladder urine: pus, 4 plus; red blood cells, 4 plus; albumin, 1 plus.

Roentgenogram. Entirely negative for stone, tumor or tuberculosis.

Pyelogram. Pronounced dilatation of left renal pelvis with 30 c.c. capacity; upper ureter markedly dilated with definite obstruction 4 cm.

above bladder, which point is located by hang of wax bulb in this portion of ureter (Fig. 5).

This patient received four treatments, dilating the ureter to 4½ mm. bulb and she was fitted with a proper abdominal supporter. At the time of discontinuing the treatment, the urine was pus-free and blood-free, with marked relief of all symptoms. Request to report in three months was not complied with and no later report is available.

Fig. 5.

Case v. Mrs. H. L., aged fifty-seven, quartipara, first seen August, 1924. Her trouble began ten years before with vague right loin pain, reflected forward along the course of the ureter down to the bladder and with vesical frequency and irritability.

No history of definite, acute attacks of abdominal pain which might be interpreted as appendicitis, cholecystitis, or pyelitis. For past three months the discomfort has been constant, accompanied by persistent pyuria, not yielding to bladder irrigations.

Physical Examination. Rather large and fleshy with tender, palpable, somewhat enlarged, right kidney and marked tenderness over the right ureter at the pelvic brim. Left kidney negative.

Catheterized bladder urine: pus 2 plus; a few red cells, trace of albumin. Urine from right kidney: pus, 1 plus; few red cells; no albumin.

Roentgenogram. Right kidney somewhat low; no evidence of stone.

Pyelogram. Calyces normal in outline; slightly dilated pelvis; ureter dilated above obstructoin 3–4 cm. above bladder (Fig. 6).

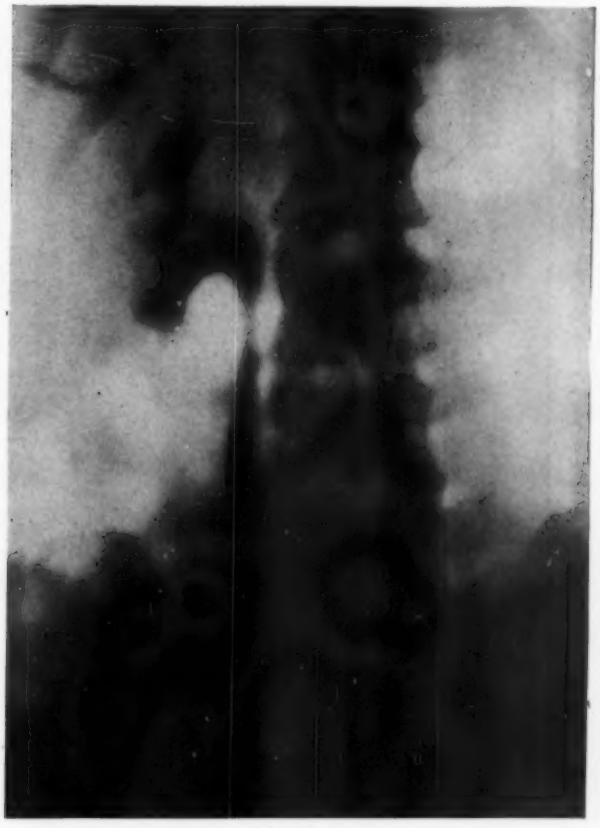

Fig. 6.

Cystoscopy. Congested base and trigone; right ureteral orifice small and pouting; a 4 mm. bulb passes with difficulty through the obstruction about 4 cm. above the bladder corresponding to the narrowing shown in the pyelogram.

A rather stormy reaction followed this instrumentation, reproducing in aggravated form all of the old symptoms and pain.

In cases in which pronounced reactions occur, experience has shown that there should be no repetition of treatment until all the acute symptoms have entirely subsided; usually three to four weeks.

Case vi. Mrs. H. B., aged forty-three, nullipara. Six years ago had acute attack of cystitis (?) lasting one week; two years ago had severe attack of pyelitis, with chills and high fever, lasting for two weeks. Since this attack has had constant pain in back, more pronounced on the left side, with a loss of 26 pounds in weight. Nine years ago suspension of uterus, removal of appendix and right ovary.

Physical Examination. Lower thorax contracted, with deep epigastric angle; general visceroptosis with both kidneys enlarged, movable and palpable. Marked tenderness over both ureters at pelvic brim. Catheterized bladder urine: Pus, 1 plus; no red cells, no albumin.

Roentgenogram. Negative for stone; both kidneys low-lying.

Cystoscopy. No. 8 catheters, armed with 5 mm. bulbs and passed at different times, reveal obstruction in both ureters in broad ligament area, 3 or 4 cm. above the bladder; pyelograms first made with catheter well up to kidney, after which, the catheter was drawn down until the bulb obstructed in the tight area, and a second pyelogram was made (Figs. 7 and 8).

This case illustrates the importance, if one wishes really to demonstrate ureteral twists and renal stasis, of having at least one exposure with the catheter brought well down into the ureter, so that there is no "splinting" at any point of the drainage canal. With the omission of this point in the roentgenographic technique, one can readily see that pathologic processes may be missed.

Fig. 7.

Fig. 8.

Many such cases as this one, in former years, were promptly subjected to one of the numerous varieties of kidney anchoring operations; and sometimes, with marked relief of symptoms; the reason being that better kidney drainage was established from above.

Now, many of these cases have been shown to have obstructive lesions also at one or more points within the ureter and may be more safely and conservatively handled by ureteral dilatation and proper abdominal support. Obstruction at the ureteropelvic juncture, caused by an aberrant vessel or from adhesive contrictions, calls, of course, for the proper surgical measures.

THE AFTER-TREATMENT OF FRACTURES ABOUT THE ELBOW

K. G. Hansson, M.D., and R. G. Birrell, B.A., M.B.

From the Department of Physical Therapy, Hospital for the Ruptured and Crippled

NEW YORK

In the evolution from quadruped to biped posture, the lower extremities take up the burden of weight-bearing and locomotion, while the upper extremities assume the duties of body servants. It therefore becomes evident that in repairing any injury to the lower extremities, we have to bear in mind the ultimate stability necessary for locomotion, while our goal in the treatment of injuries to upper extremities should be that of full range of motion.

The most common serious injury to the extremities is a fracture. The most common fracture in older people is one about the hip joint, in adult life the fractures about the wrist, and in children, by far the most common fracture is that about the elbow joint. As is well known, non-union and delayed union are not uncommon after fractures of the weight-bearing lower extremities, while non-union in fractures about the shoulder joint, elbow joint or wrist joint is extremely rare. Limitation of motion following fractures about the joints in the upper extremities is, however, very common and assumes a greater importance than the same limitation in one of the joints of the lower extremities, because more people earn their living with the help of the upper extremities than with the help of the lower extremities.

In an orthopedic hospital, the patients with limitation of motion in the elbow joint following a fracture reach a very high percentage, and the number of such fractures admitted to the Hospital for Ruptured and Crippled during the year 1925 was 100 out of 828, which represents the total of fractures admitted during the same period.

We have taken for our material 100 successive cases sent for after-treatment to the Department of Physical Therapy of the Hospital for Ruptured and Crippled.

Fourteen cases had open reduction. Of complications encountered, we had two cases of myositis ossificans, one of which was discharged with 87.5 per cent normal function; the other one was discharged with 81.9 per cent normal function. No cases of myositis ossificans or Volkman's contracture, admitted as such to the hospital, are included in the series. One case developed arthritis and was discharged with 88.8 per cent of normal function. The series includes 5 cases with nerve involvement. The radial nerve was involved in 1 case and the ulnar nerve was involved in 4 cases. These nerve lesions did not show any R.D. and all recovered in from five to nine weeks except the case with the radial nerve involvement, which persisted for six months.

Sir Robert Jones has laid down the generally accepted rule for the emergency treatment of these fractures. He thereby changed the medical profession's attitude toward fractures about the elbow from one of fear to one of assurance. Sir Robert Jones' "Golden Rule of Treatment" says, "They should all be treated with the elbow fully flexed and the forearm supinated with the single exception of fracture of the olecranon, which requires full extension." This treatment is so generally known that few doctors, be they general practitioners or specialists, pass up the opportunity of treating a fracture about the elbow. The after-treatment, however, is little understood.

These are the facts that have prompted us to make this study of the after-treatment and, although it applies to fractures about the elbow in particular, the general

rules may probably be applied to the after-treatment of fractures in general.

TABLE I
AGE

	Per Cent
From 1–10 years	66
From 10–20 years	27
Over 20 years	7

TABLE II
SEX

	Per Cent
Males	89
Females	11

Table I and Table II only bring out two well-known facts about these fractures, i.e., they are most common in children and more common in boys than in girls.

ANATOMY

The bones taking part in the elbow joint develop from not less than seven centers of ossification. It is really a joint with three articulations; one between the humerus and radius, the second between the humerus and ulna and the third between the radius and ulna. Due to the difference in size between the articulating surfaces of the capitellum and the trochlear and the obliquity of the latter, the axis of the extended and supinated forearm is not in the same line as the axis of the humerus. Thus the carrying angle is produced for the purpose of clearing the forearm from the pelvis and therefore the carrying angle is most marked in the female.

The lateral and medial epicondyle serve as origin for the flexors and extensors of wrist and fingers, and the olecranon is the insertion of the strong triceps and this accounts often for the separation of fragments after fractures about the elbow.

It is also of importance to remember that the very delicate movements of hand and fingers are dependent on the integrity of supination and pronation of the forearm which can only take place with a freely movable radioulnar joint.

Table III shows that 50 per cent of our cases did not come for after-treatment until more than one month had passed. Table V brings out the fact that there is a direct relation between the length of time from reduction to beginning of after-treatment, and the number of treatments required to produce the maximum results. The average number of treatments for a patient who comes for after-treatment in the first three weeks following reduction was 12.6, while the corresponding number of treatments for a patient who presents himself after one month was 23.

TABLE III
FREQUENCY OF SITES INVOLVED

Supracondylar	22	Upper radius	8
Int. condyle	10	Epiphyseal sep. of hum.	7
Ext. condyle	21	Epicondylar	1
Olecranon	1	Upper ulna	1
Intercondylar	2	Dislocations	5
Capitellum	1	Not classified	21

TABLE IV
TIME WHEN AFTER-TREATMENT WAS BEGUN

	Per Cent of Patients
First week	2
Second week	15
Third week	20
Fourth week	13
More than one month	50
	100

TABLE V
NUMBER OF TREATMENTS IN RELATION TO TIME BETWEEN REDUCTION AND AFTER-TREATMENT

	Per Cent of Patients	Number of Treatments
First week	2	10
Second week	15	13
Third week	20	15
Fourth week	13	19
More than one month	50	23

TABLE VI
AVERAGE GAIN OF FUNCTION IN DEGREES COMPARED WITH TABLE IV AND TABLE V

	Per cent of patients	Number of treatments	Per cent gain in function
First week	2	10	100
Second week	15	13	73.2
Third week	20	15	68.3
Fourth week	13	19	73.3
More than one month	50	23	64.6

In Table VI, we see that the average gain in function in degrees of range of motion in flexion and extension was 100

degrees in the early patient and 64.6 degrees in those who came more than one month after reduction.

If we analyze Table VI, it is undeniable that the time of immobilization in fractures about the elbow is responsible both for the length of the after-treatment and amount of gain in function obtained.

The question of how long we should completely immobilize these fractures is, therefore, forced upon us. The medical profession seems at great variance as to the answer, when some patients are sent for after-treatment the first week and others, 50 per cent of them, were completely immobilized for over one month.

AFTER-TREATMENT

The after-treatment of fractures in general usually suffers from insufficient attention of the surgeon, who is mostly interested in the reduction of the fracture and willing to take a gambler's chance on the functional end-result. On the other hand, the after-treatment is often turned over, with little or no instruction, from surgeon to more or less trained technicians.

Very able books on fractures have been published, but the few notes they contain about the after-treatment are hazy, often misleading, and the therapeutics advocated are empirical, to say the least.

Upon what shall we base the after-treatment of fractures? In this article, we shall attempt to give a short résumé of the physiological healing of a fracture, based on the most recent experimental work on the repair of bone. We will then show how one can synchronize the chronological bone repair with the application of physical means. What takes place when the continuity of a bone is destroyed by violence and how can we help the repair? For practical purposes, we will divide the answer to these questions into five stages.

First Stage. The immediate result of a fracture is a hemorrhage which is central, subperiosteal and muscular and may extend along fascia and subcutaneous tissue. This hemorrhage produces the clinical symptoms of pain, swelling and muscular spasm. These three symptoms indicate clearly nature's attempt at immobilization and, after the best possible reduction has been accomplished, our efforts should be to maintain this reduction by effective, but not constricting, immobilization. The immobilization of the fragments is so important in this first stage of repair, that any attempt at relieving the pain, muscular spasm or swelling by gentle effleurage, as advocated by Lucas-Championnière, thereby jeopardizing the reduction, seems neither rational or safe.

Second Stage. A few hours after the fracture, a productive inflammatory process begins which, through the granulation tissue formed and the exudate of fibrin and serum, changes the hemorrhage into a hematoma. The clinical symptoms of pain, swelling and muscular spasm persist and they tell us to keep our hands off and maintain the immobilization.

Third Stage. Forty-eight to seventy-two hours after the reduction the blood clot surrounding the fragments is further organized by connective tissue that has grown in from the periphery. Osteoblasts appear on the stage and some bone matrix is formed from the intracellular substance. By this time, the pain and muscular spasm have disappeared and swelling decreased.

Fourth Stage. On the fourth or fifth day, we have a soft callus consisting of osteoid tissue. The calcium salts (calcium phosphates and calcium carbonates) are deposited in the connective tissue stroma of the perivascular areas. These salts are carried in the circulation by colloids and by carbon dioxide and are also available from the fractured ends of the bone by a process of demineralization and atrophy. The calcium phosphates and calcium carbonates are in solution in an acid media. It is, therefore, believed that the hydrogen-ion concentration becomes lowered, and when this reaches a certain point below that of the blood plasma, precipitation of the calcium salts occurs. If, at this stage, the splintage permits, it is easy

to see how the application of heat will help to restore the condition of the soft parts about the fracture. The physiological action of heat, however, also tends to lower the hydrogen-ion concentration of the blood and, therefore, is helpful in the precipitation of the calcium salts.

Fifth Stage. Between the second and the third week, the connective tissue is well organized and new blood vessels are seen. Osteoid tissue appears in the perivascular areas and there is a gradual transition in the appearance of the cells from connective tissue to osteoid tissue to bone.

The absorption of the excessive callus begins and there are signs of the re-establishment of the bone marrow.

At this stage, the patient often complains of stiffness in the shoulder, elbow and wrist joint and the soft parts about the fracture are described as being without life. Now we are dealing with a convalescing joint where the bony repair has gone on to a soft callus and there is no muscular spasm, swelling or pain which contraindicates manipulation.

By using these observations as a criterion for the after-treatment, it seems rational to fix the end of the second week after reduction as the beginning of the after-treatment. For anybody who understands this process of bone repair and who has any knowledge of and respect for the physiological significance of pain, it seems incredible that most surgeons dealing with fractures still prescribe massage of the elbow and passive motion for the after-treatment. Gentle massage of the soft parts above and below the elbow is of great value, but any massage about the joint and over the callus is of little or no help and may produce excessive callus and myositis ossificans. It is easy to conceive how massage will dislodge osteoblasts and spread them in the soft tissue and accelerate their growth or increase the transition of connective tissue cells or muscle cells into bone-producing cells. Therefore massage about elbow joint and in the vicinity of the callus is contraindicated.

Any attempt to regain the function of the elbow by means of forceful passive motion in a child screaming from pain, only adds another chapter to the history of inquisition, and the result obtained compares favorably with the results obtained by painful passive motion in the early treatment of fractures in children. If good results are obtained with massage and passive motion of the elbow, it only shows the wonderful compensatory power the human organism is capable of when exposed to insults by members of the healing art.

The after-treatment consisted in all our cases of external heat, internal heat by means of diathermy, massage and therapeutic exercises. It seems justifiable to review briefly the physiological actions of these physical means.

HEAT

The calorific or heat rays make up the red rays or the least refracted rays of the visible sun-spectrum and, also, the invisible infra red rays. In the electromagnetic spectrum, they are found to have a wave length of from 3800 to 9000 Ångström units. Other properties, beside refraction, are reflection, absorption, penetration and polarization.

When heat in any form strikes the human body, there is an increase of the surface temperature. To protect the body against any excessive increase of heat, the heat-regulating mechanism responds with a hyperemia. The capillaries are dilated, heart action is increased and the circulation accelerated. Thereby, some heat is carried into the systemic circulation and some is eliminated through the more rapid respiration. The sweat glands increase their activity and begin to eliminate and everything tends to keep the body temperature at a constant level. On application of heat, the musculature relaxes and the sedative effect on the sensory nerve-endings is well known and, probably, also acts reflexly on deeper structures.

The reaction of the sweat, saliva and

urine shows first increased acidity and later alkalinity. The reaction of the blood becomes less acid or alkaline as measured by the hydrogen-ion concentration.

The practical application of external heat may be divided into conductive heat and convective heat. Under conductive heat, we include all measures where the source of heat is in direct contact with the skin. Hot applications and the different forms of hydrotherapy belong here. The whirlpool bath, where the water under 50 lbs. pressure and heated to about 115°F. is led into a basin, producing a whirl, is the method to prefer. The cleansing effect of the water, the heat and the molecular massage of the activated water is of great benefit to a limb that has been encased in plaster for some time. However, as the rest of the treatment of the fractures can hardly be given in the hydrotherapy department, our patients were given whirlpool baths only the first week and, thereafter, the convective heat was used. This consists of exposing the patient to any source of heat at a distance from the body.

For this purpose, we make use of carbon filament incandescent lamps. They can be used on a stand with a reflector over the lamp to throw the heat rays parallel; or several lamps are mounted on a bridge or heater, incorrectly called "baker." This heater is put over the elbow, which is thus exposed for fifteen to twenty minutes.

In order to study the effect of various physical means on the peripheral circulation, we have made use of an intradermal injection of normal saline. Normal saline 2 minims was injected, intradermally, on the volar surface of forearm, 10 cm. below the elbow and this area exposed to various forms of heat. The absorption of this injection in normal individuals, without treatment, was determined at sixty minutes. When such an injected area was exposed to the whirlpool bath the absorption of the saline was determined at seventeen minutes; when exposed to a carbon filament lamp on a stand, 60 cm. from the skin, the absorption time was twenty-five minutes and when using the heater with 12 carbon filament lamps, the absorption was accomplished in thirty-one minutes. This gives a rough estimation of the effect of external heat on the peripheral circulation. Even though much of the applied heat is absorbed and carried away by the blood stream, it is only rational to believe that some heat penetrates deeper, by means of conduction, in the tissue underlying peripheral circulation.

DIATHERMY

In addition to the conductive and convective heat, we speak of conversive heat, which means heat produced in the tissue by means of its resistance to a high frequency current, oscillating between two electrodes. The diathermy current used therapeutically has a voltage of 1000–10,000 and an amperage of 200–4000 milliamperes. The oscillations vary from 1,000,000 to 2,500,000 per second. These rapid reversals of the current prevent the occurrence of any chemical effects or any neuromuscular responses. The therapeutic value of diathermy is, therefore, based solely on the development of heat.

In applying diathermy to an elbow, we have three techniques to choose from. We may place the two electrodes on opposite sides of the joint or we may place the electrodes in the form of cuffs, one above and one below the elbow. The third technique consists of placing one electrode over the lower half of the triceps and an equal sized electrode over the volar surface of the forearm, just below the elbow. The first-named method has been used by us, and the average size of the electrodes was 4×8 cm. The contact surface was moistened by warm soap-lather and the electrodes held in place by rubber bandages. It is safe to send 1000 ma. through these electrodes, but any rule as to the dosage of diathermy should be governed by the tolerance of the patient. With the spark gaps closed, the current is turned on slowly and then the spark gaps are opened till the milliameter reads 300–400. This is

gradually increased, until, after about two minutes, the milliameter reads the dosage desired. This is maintained for about twenty-five minutes and the current is turned off gradually.

Although the question of where the maximum heat is produced is not settled, it cannot be denied that heat is produced in the path of the high frequency current. This is especially true, when we deal with electrodes of the size mentioned above, where the distance between the electrodes is usually less than 10 cm. and the amperage varies from 500–1000 milliamperes, with the relatively higher voltage delivered by the latest diathermy machines. This secures a high current density. By current density is meant the amount of electrical units per square section of the medium, and this current density is a necessary factor in the production of conversive heat.

The intradermal saline test gave us a reading of thirty-two minutes.

MASSAGE

Sir Robert Jones has said that the value of massage is too well established to require defense, but it cannot be denied that many of the ideas prevalent as to its methods of use are often vague, and surgeons who have made a close enough study of the subject to give definite directions to a masseur are still fewer than they should be.

The main physiological effects of massage are:

1. Assisting the circulation.
2. Aiding the movement of lymph.
3. Exerting tension on some structures which we hope to free or stretch.

The absorption time of intradermal saline, when treated with massage, was ten minutes, compared with sixty minutes for the untreated injection.

Championnière has studied the histological changes that take place when soft tissues are crushed. He found:

1. Dissociation into fibrillae of muscular fibers, as shown by well-marked longitudinal striation.
2. Hyperplasia, sometimes a simple thickening of the connective tissue.
3. Increase in places of nuclei in connective tissue.
4. Interstitial hemorrhages.
5. Enlargement of blood vessels with hyperplasia of their adventitious coats.
6. Multiplication of nuclei in the sarcolemma, resembling interstitial myositis.

When massage was applied to these tissues, he found the following histological picture:

1. Muscle appeared normal.
2. No secondary fibrous bands separated the muscle fibers.
3. No fibrous thickening around the vessels.
4. General bulk of muscle was greater.
5. There was no sign of hemorrhage.

The therapeutic application of heat produces a loss of acid or an alkalosis as mentioned above. The acid base equilibrium also undergoes striking changes in exercises, as shown by Barr and his co-workers. The result in exercises being an acidosis, due to the production of lactic acid and CO_2.

The effect of massage on the body fluid reaction, according to Pemberton, is a restoration to normal. The application of massage should be left to technicians chosen for their skill rather than their personality. Supple and warm hands, with an educated sense of touch, are preferable to great strength. Any hard massage that calls forth a protective contraction is an error in technique. A good way of judging a technician is by the way she places the patient for the treatment. The patient should be in a position that permits the utmost possible relaxation and that is the recumbent position. This applies to the treatment of the upper extremities as well as any other part of the body. The kind of lubricant a technician uses usually shows her experience. For any normal skin, a lubricant with a fatty base is best, but when a skin shows tendencies to eruptions about the hair follicles, a soft powder is preferable. As mentioned above, massage

should not be used about the callus in fractures about the elbow, but is of great value above and below the elbow.

THERAPEUTIC EXERCISES

The physiology of exercises or muscular contractions may be reviewed as to their

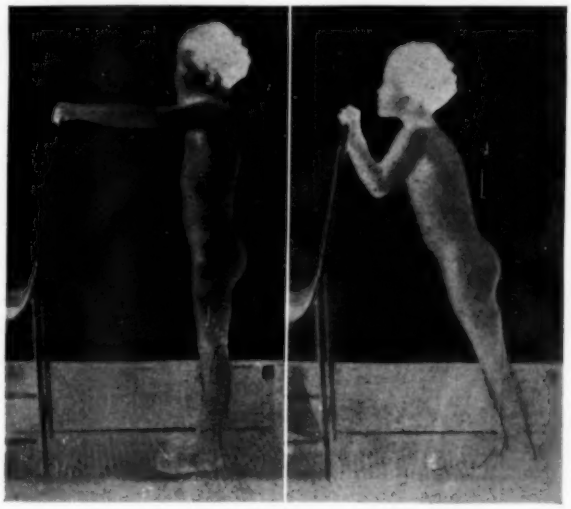

Fig. 1.

local and general effect, but in relation to fractures about the elbow only the local effect is of interest to us. In order to get a muscular contraction, we must have nerve stimuli, the contractility of muscle fibers and the fuel of carbohydrate and fat. The physiology of muscular contractions may be divided into.

1. *Mechanical,* which is produced by means of approaching the muscle's origin and insertion on skeletal parts, which act as levers.

2. *Metabolic.* The muscle utilizes carbohydrate and fat for its contraction, leaving as waste products lactic acid and CO_2, which are probably responsible for muscle fatigue. Protein is mainly repair material.

3. *Thermal.* An increase of temperature always follows muscular contractions.

4. *Electrical.* There is some change in the electrical potential of the muscle, preceding and following the contraction.

5. *Functional.* By systematically continued muscle contractions, there is an increase of volume, tonicity and power of the muscle.

In the after-treatment of fractures about the elbow, we make use of the mechanical effect of muscle contractions, because of their pull on the skeleton, in order to prevent or correct deformity.

Sir Arthur Keith has formulated the relative function of muscles and ligaments of a joint, when he says: "Ligaments come into action only when the normal muscular support and defense of a joint has broken down." When we realize the physiological truth in this statement, we can understand how irrational it is to advise a patient with a flexion deformity of the

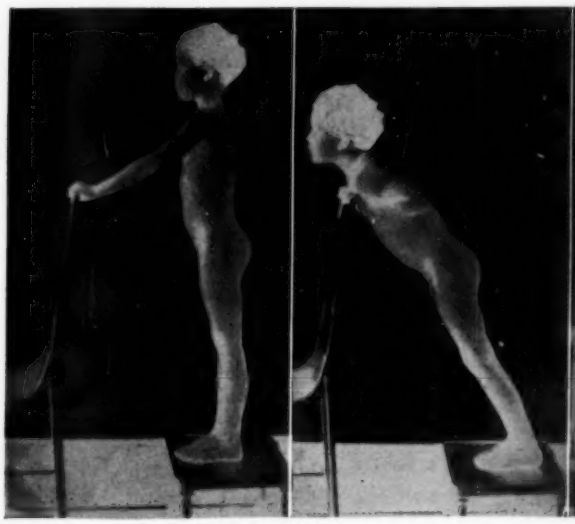

Fig. 2.

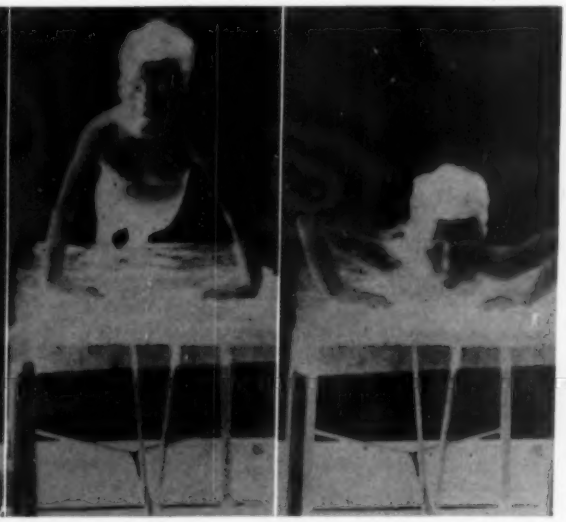

Fig. 3.

elbow as follows: "Go home and carry a heavy weight in your hand, and the elbow will straighten out." The patient carries the weight as long as the flexor muscles of the elbow permit and then drops it. If he is conscientious, he repeats it often and develops strong elbow flexors, which only increases the deformity by counteracting gravity, which, if left alone might have corrected the deformity.

Exercises may be divided into active, passive and resistive.

By active exercises, we mean voluntary contractions of muscles by the unassisted patient. During the first week of treatment, the patient goes through the motions of elbow and forearm to the best of his ability.

Passive exercises comprise exercises performed on the patient by means of apparatus or by a technician. As mentioned elsewhere, these forcible manipulations of the elbow do not belong in modern therapeutics. They are unphysiological, the benefit from them is very questionable and they may produce a myositis ossificans.

Resistive exercises are performed by a technician in cooperation with a patient, or by the patient herself, using her body weight or some apparatus for resistance. In the second week of treatment, these resistance exercises can be started. If the biceps is contracted in an attempt to flex the elbow, the inner and outer head of the triceps will contract in elongation, but if resistance is offered to flexion of biceps, the triceps will relax instantaneously. The type of exercises used in our after-treatment is shown by Figures 1, 2 and 3. The principle is to apply the partial body weight in increasing amount to the elbow in maximum flexion. Again, when elbows are extended against the body weight, the triceps are strengthened, which will promote extension of the elbow. These exercises are to be repeated to the point of fatigue.

It is evident that any treatment such as we have attempted to outline has its limitations. It can be given only in a well-equipped department of physical therapy. It is practical to give such a treatment only once a day or every other day. That means one hour of treatment out of twenty-four or forty-eight hours of inactivity. As soon as immobilization is dispensed with, the patient begins his home treatment, consisting of the exercises shown in Figures 1, 2 and 3. These are repeated every three hours.

TABLE VII

END-RESULTS

End-results expressed in per cent of normal function

Time of immobilization before after-treatment began	100–90	90–80	80–70	70–60	60–50	50–40	40–30
1st week	1	1					
2nd week	2	5	2	1	3	2	
3rd week	11	2	2	2	..	2	1
4th week	5	6	..	..	2		
More than one month	14	10	6	10	6	2	2
Total per cent	33	24	10	13	11	6	3

The end-result was calculated as follows: If we take flexion to 30° and extension to 180° as normal, we have a normal range of motion of 150° of which 60° is flexion and 90° is extension. If we take the midposition of the forearm as 0° we have complete pronation at 90° and complete supination at 90°. If a patient was discharged with flexion to 45°, extension to 135°, pronation to 45° and supination to 90°, we may say that flexion was 75 per cent of normal, extension 50 per cent of normal, pronation 50 per cent and supination 100 per cent. This gives us a collective end-result of 68.75 per cent of normal. Our end-results compare favorably with other reports on fractures about the elbow, although the comparison suffers from the difference of opinion in interpreting perfect, good, fair and poor result. König, reporting roentgen-ray findings three years after the fracture about the elbow, makes the statement that in children even marked deformities disappear. It therefore seems rational to base the end-result on function alone,

Neuhof and Wolff studied 100 cases and reported perfect result in 53 per cent.

Ritter and his co-workers report about the same functional end-result percentage.

In our series 20 per cent of the patients had been first treated in other hospitals and 15 per cent were sent in from private doctors. It is evident that these cases represent failures or they would not have been sent to an orthopedic hospital. Of our 100 cases, 14 had open operations.

CONCLUSIONS

Our study leads us to believe that the immobilization of fractures about the elbow, carried on more than one month, is responsible for longer after-treatment and, usually, incomplete return of function. The question of when to start the after-treatment, therefore, comes up, and we have tried to answer this, by using the physiological bone repair as a criterion. This should suggest the end of the second week after

THE HOSPITAL FOR RUPTURED AND CRIPPLED

PHYSIOTHERAPY DEPARTMENT

DATE: MARCH 6'27 NAME: NUMBER:

DIAGNOSIS: FRACTURE OF EXT. CONDYLE Lt ELBOW.

ELECTROTHERAPY

GALVANISM	TIME	PART	STRENGTH
CONTINUOUS-IONISATION			
—POLE TO		+POLE TO	
INTERRUPTED			
FARADISM			
BRISTOW-COIL			
SINUSOIDAL			
SLOW-MED.-RAPID			
HIGH FREQUENCY			
3 DIATHERMY	25'	Lt. ELBOW	800 MA.
OUDIN			
AUTOCONDENSATION			
GENERAL-LOCAL			
STATIC			
WAVE			
SPARK			
BRUSH OR BREEZE			

HYDROTHERAPY

			TEMPERATURE
CABINET			
SCOTCH DOUCHE			
1. WHIRLPOOL	15'	Lt. ELBOW	115°

HELIO-THERMOTHERAPY

			DISTANCE
RADIANT LIGHT			
2. ~~BAKING~~ HEATING	15'	Lt. ELBOW	
DEEP THERAPY LAMP			
ULTRA VIOLET			
AIR COOLED			
WATER COOLED			

MASSAGE

4 GENTLE-MED.-DEEP		Lt. UP. EXTR EXCEPT. ELBOW	
VIBRATION			

MECHANOTHERAPY AND GYMNASTICS

5 ACTIVE ✓		FLEX, EXT. SUP & PRON. Lt.	
PASSIVE		ELBOW.	
MEDICAL GYMNASTICS			
ZANDER			

SM-10-26 Hansson M.D.

FIG. 4. The therapeutic card used at the Hospital for Ruptured and Crippled. (1), (3) and (5) comprise the treatment the first week; (2), (3), (4) and (5) comprise the treatment from the second week on.

the time of reduction, as a safe time for the beginning of the after-treatment.

We further believe that:

1. Massage and passive motion of the elbow are contraindicated, because they are unphysiological and may produce myositis ossificans or, at least, excessive callus.

2. Early application of heat and active motion to the injured part promotes early functional restoration.

3. The after-treatment should not be entrusted to technicians without supervision. It should include physical means, the physiological action of which is well understood and well conducive to nature's way of healing and restoration.

4. Any treatment by physical means that may require one hour out of every twenty-four or forty-eight hours is insufficient and of little avail, if it is not followed up by some home exercises, which can be repeated every two or three hours.

5. In spite of best efforts at reduction as well as after-treatment, about 10 per cent of the fractures about the elbow will show poor end-results.

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AN IMMOBILIZING CAGE

FOR THE TREATMENT OF BURNS AND SKIN GRAFTS*

A. J. HOSMER, M.D., F.A.C.S.

SALT LAKE CITY

THE object of this communication is to emphasize the importance of a therapeutic principle, and a mechanical agency for carrying it into effect, in the management of burns and other injuries resulting in the destruction of skin and requiring skin grafts. Although this principle and its agency are in aid and furtherance of accepted knowledge with respect to the pathology of burns and with respect to many of the remedial methods thus far employed, they seem, from a review of the modern literature, to be novel. No use seems to have been made of the mechanical agency in question and the principle itself is only incidentally and casually recognized in the literature. The principle is that of immobilization. The agency is an "immobilizing cage" consisting of heavy (No. 8 gauge) wires strung between and set into plaster casts adjusted to portions of the body on opposite sides of the burned area, in such a manner, as shown by the accompanying pictures, as to result in what may be called a skeleton cast, causing a complete fixation or immobility of the affected area and giving aid to recovery and treatment, both because of immobilization as such and because of certain resultant conveniences in and opportunites for treatment afforded by the cage.

A survey of the literature with respect to the treatment of burns and skin-destroying injuries and with respect to the application of skin grafts shows a substantial unanimity of opinion upon a number of factors and problems. One of the problems involved is pain, with its accompanying psychic shock. In skin cases, pain is caused largely by two things: One of these is movement of the affected part or area, including both movement of the part or area as a whole by bending, and movement by contraction of the underlying muscles. The other is the application and removal of dressings.

A second problem is that of disturbance of the reparative process (briefly commented upon below) as a result of which the graft does not "take." This disturbance of the reparative process is, again, due to motion. This breaks up the delicate new circulation and loosens or separates the two raw surfaces—the granulating surface and the under surface of the implanted skin. The base may be suitable and the graft perfect, but movement of either, or underlying movement disturbing both, will spell failure.

A third and serious problem in connection with the treatment of burns, a problem especially met in burns of the third and fourth degree, is that of contractures, with consequent deformity and sometimes destruction of the usefulness of the affected part. Recent literature is also agreed that raw burned surfaces heal more kindly and quickly if exposed to the air and to natural light, and some authorities endorse the use of artificial light, claiming that it not only helps to keep the wound sterile, but that it lessens pain. And certainly we are all agreed that "the old method of applying solutions, ointments and dressings, only to tear them off from day to day, with consequent destruction of Nature's repair work, and with attendant nerve-racking pain and discomfort," should be improved if possible. The use of tannic acid in a 2½ per cent to 5 per cent aqueous solution, applied frequently (preferably every half hour) by spraying, the frequency of its

* Read before the Salt Lake County Medical Society.

application to be diminished as soon as the burned section is seen by its brown color to be well tanned, is now recognized, and its advantage over such drugs as picric acid and such agencies as paraffin is established. Edward C. Davidson, who first used tannic acid in the treatment of burns and whose paper[1] is worthy of study by every medical man, has shown by his research the advantage of tannic acid treatment of burns over other methods in general use. His review of the pathology appears to prove that the constitutional reaction occurring after burns is due mostly to a toxic substance formed by the burned tissue.

We cannot remove the dead tissue mechanically with safety except where the burned area is small, though in some cases where the burn is deep and the surface small this is advisable, followed at once by skin graft. Tannic acid, when properly applied, produces a local coagulation of the devitalized tissue where the burn is superficial and thus prevents reabsorption. It precipitates, that is, makes solids of, the poisonous burned tissue. Solids are not absorbed. Davidson says:

> It is believed that lessening of the toxemia should be attributed to precipitation of the toxic material of the burned tissue by the tannic acid applied, since such explanation is in keeping with all of the observed effects produced in vitro. The maintenance of local tissue dehydration by direct exposure to the air is probably an important factor during the early period of treatment. This not only prevents loss of body water but would appear to keep the toxic material out of solution. This explanation is strongly suggested by the cases in which symptoms of acute toxemia develop promptly following the application of moist boric acid dressings to the dry and crusted surface. . . . It is worthy of emphasis that the analgesic effect of tannic acid is one of its most striking features.

There are many reports of series of cases treated with tannic acid since Davidson introduced it in 1925. Bancroft and Rogers[2] of New York City report a series of cases and say:

> Tannic acid seems to be the best method at present for the treatment of burns. It relieves pain, diminishes absorption of toxic products and makes the care of the patient much easier from all points of view.

Beck and Powers[3] of Cleveland, report a series of cases, and point out the advantages of tannic acid over other methods of treatment. They particularly emphasize the advantage of applying the solution by means of a spray, instead of by compresses, followed by exposure to the air.

We also know from our studies of burns that a deficiency of the chlorides is likely to occur so that, to use a lay phrase, the "blood gets thick." Here the liberal use of normal salt solution, either intravenously or in some other manner such as will thin the blood and add chlorides to it, is indicated.

For the first few days a graft lives upon the host's lymph. In other words, it is "parasitic." Hence the graft must be bathed in lymph, not blood; and the graft should be so spread out and adjusted to the surface of the host that it is bathed in this nutritive fluid. The graft may die from lack of lymph nourishment before the new blood supply is established.

After the first forty-eight hours it is the delicate budding capillaries that furnish nourishment to the transplanted skin, without which the transplant would die. It is evident that any movement which would displace the two opposing surfaces of the host and the graft would destroy these new delicate vessels, with the resulting death of the transplant.

From the brief preliminary discussion above of the factors and problems connected with the treatment of burns and skin-destroying injuries, and with the application of skin grafts, and from the above discussion of modern therapeutic methods and the physiology of the reparative process, it will be seen that the

[1] *Surg., Gynec. & Obst.*, 1925, xl, 202.

[2] Bancroft, F. W., and Rogers, C. S. Treatment of cutaneous burns. *Am. Surg.*, 1926, lxxxiv, 1–18.

[3] Beck, C. S., and Powers, J. H. Burns treated by tannic acid. *Am. Surg.*, 1926, lxxxiv, 19–36.

following are desiderata: (1) Immobilization, to prevent pain, to prevent contractures, and to prevent interference with the process of repair. (2) Discontinuance of dressings, to prevent pain, to prevent interference with the process of repair, and to make possible exposure of the affected area to the air and to natural and artificial light as remedial agents. (3) Ease or convenience in the application of tannic acid by direct spraying over the raw surface.

The cage shown in the accompanying photographs seems to meet these needs.

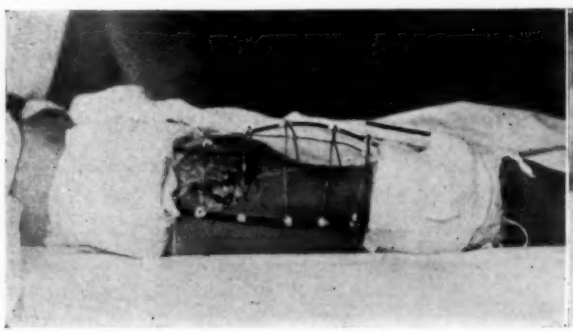

Fig. 1. Case 1.

Fig. 2. Case II.

It produces complete immobilization, by preventing both bending of the injured part and movement of the underlying muscles; it dispenses with the necessity of dressings and gives direct and easy access to the burned surface for air, light, and the tannic acid spray. At the same time it conveniently and effectively prevents any foreign thing, for example the bed clothing, coming in contact with the wound.

The immobilizing cage should be applied as soon after the burn as possible, because as soon as it is in place and the parts are immobilized the pain stops and local treatment with tannic acid or light, without contact or dressings, may at once be commenced, without disturbing the patient. If the burn fortunately happens to be one of the first or second degree, it will then heal kindly under the crust formed, if tannic acid is used, and new skin will push off the dry crust. It may at times be expedient to moisten this crust with salt solution, or with Dakin's solution, either by spray or with wet gauze, so that the wound will clear up more quickly and odor will be prevented. If the burn is of the third or fourth degree, the immobilizing cage effectually prevents contractures and protects the immobilized parts so that after the sloughing tissue has come away by itself, or has been removed by the surgeon, and the granulating surface becomes suitable, skin grafts may be placed without further difficulty and with the assurance that the new skin, undisturbed by movement and change of dressings, will live if properly applied. In deep burns of small surface the dead skin crusts should be removed immediately and skin grafts applied. In sloughing cases the grafts should be applied soon after the slough separates.

As well as other surgeons, I have for years used plaster of Paris and wire in cases of compound fracture, gun-shot wounds, etc. to fix the extremities and to make the open wounds accessible; and we have also used wire in places to secure strength with less plaster. But until comparatively recently I have not used these two common surgical aids for immobilizing and caging for burns and skin grafts; and, so far as I can learn, no other surgeon has made use of them for this purpose. The following two cases are selected from several to illustrate graphically the principle of immobilization and its application through the agency of a cage.

Case 1. G. C., male, aged 16 years, entered the Holy Cross Hospital at Salt Lake City,

Utah, August 30, 1926. The past medical and surgical history was negative.

Present history: The boy was horseback riding on August 24, 1926, when his horse fell and stepped upon him. The skin was torn from the inner and upper part of the right thigh, the injured area being about sixteen inches long and twelve inches wide. The denuded surface included much of the anterior and inner aspects of the upper part of the thigh and extended as far as the edge of the scrotum and included some of the skin of the buttocks. The detached skin had been carefully sewed back in place by the local attending physician, J. A. Hagan, of Gunnison, Utah, but when the patient entered the hospital six days after the injury, this enormous flap of skin was dead—a black, stinking slough. I immediately detached the silk sutures and removed the necrotic and sloughing tissue and applied warm boric acid dressings. Twelve days later, September 11, 1926, the wound being then free from sloughing tissue and looking clean and red, the boy was taken to the operating room and the immobilizing cage was put on as shown in Figure 1. Then, under anesthesia, Thiersch grafts were taken from the left thigh and applied to the denuded area. The grafts were applied direct, i.e., without putting them in salt solution, and the entire raw surface was covered. Pains were taken to be sure that the raw area to be covered was in suitable condition, that it was free from pus or any foreign substance, that the soil was suitable for the implanted tissue. Care was taken also in seeing that the implanted skin was smoothly and accurately placed, so that its undercut surface fitted closely on its entire area over the raw tissue surface.

No dressings were applied. A sterile sheet was wrapped about the cage for warmth during the night, but much of the time in the ward the wound was exposed to the air and light.

All the grafts grew except on two small areas, one on the buttocks and one near the scrotum, where the cage was defective and the bed sheet came in contact with the newly implanted skin. On October 9 these two small surfaces were again covered with Thiersch grafts, and the cage improved so as to prevent any contact. The patient was discharged from the hospital on October 26 with the whole of the injured area covered with healthy, substantial skin.

Case II. M. H., male, aged four years, entered the Holy Cross Hospital at Salt Lake City on September 23, 1926. Past medical and surgical history negative.

Present history: On March 10, 1926, six months and thirteen days before entering the hospital, the boy, while in the yard playing with matches, started a fire. His shoe in some way became fastened between two pickets on a nearby fence and his clothing caught fire. The skin of his foot was protected by his shoe, but the skin on his entire left thigh and leg and over the buttocks and in front extending up to the ilium was entirely destroyed. The boy's clothes on the left side were burned off. His foot was finally liberated by the picket being burned away. The burn was of the fourth degree. He was treated by a local physician, with soothing dressings. His condition on entering the hospital was anything but promising. He was pale and frightened. His leucocyte count was 17,000. The burned thigh was flexed over the abdomen, with adhesions at the groin fastening the raw surfaces together. The leg was flexed on the thigh, with extensive adhesions fastening the raw surfaces together in the popliteal space. The enormous raw area of the entire member was covered with granulating tissue and was smeared with vaseline. It had a glazed, smooth surface and was comparatively free from pus or other exudate. The surgeon's first impulse in such a situation would be amputation at the hip joint. But there was no skin for a flap, and amputation would probably have resulted in death. Hence it was decided to attempt to save this little atrophied and deformed leg and cover it with new skin.

On September 24, the boy was anesthetized and put on the Hawley table. With steady, slow, careful extension, the leg was made almost straight, by breaking up the contractures. This necessitated the tearing loose of the adhesions at the groin and in the popliteal space, causing rather free hemorrhages, which were relieved by gauze pressure. I then applied the immobilizing cage. The patient was not greatly disturbed by this procedure; in fact from this time on he hardly complained of pain and, except as hereinafter indicated, he steadily improved in a general way. Through the cage I now applied to the glazed, granulating surface pieces of gauze wet in normal salt solution and these were kept

moist by spraying with the same solution. On account of the vast amount of skin required and the boy's condition at the time, it was impossible to attempt an autograft. Tests were made of his blood and it was unfortunately found incompatible with that of his mother (the boy was Type II, the mother Type IV), and also with that of any other of several available donors. Therefore, on September 29, in the ward and without giving either the mother or child any anesthetic, a few Thiersch grafts were taken from the mother's thigh and applied to the granulating surface of the child's leg just above the ankle and over the knee joint, to see whether the isografts would grow. They took favorably, and, therefore, on October 13, both the mother and child were anesthetized, and the extensive granulating surface was completely covered with skin taken from the mother. The knee joint and popliteal space were covered with whole skin or Wolfe grafts as follows: A piece of whole skin about 5 inches wide and 12 inches long, tapering at the ends, was taken from the mother's abdomen. This was accomplished by making two parallel incisions 5 inches apart, extending from near the crest of one ilium to the other, and between the pubes and the umbilicus. The skin was carefully separated from the underlying fat and cellular tissues with a sharp knife, so that the under surface of the skin was bare and smooth. This piece of skin was applied about the boy's knee joint thus: Each end was split down about 4 inches, so as to make four tails, but leaving the center of the piece intact. The middle of this big transplant, about 5 inches wide, was placed so that it covered the popliteal space. Then the four tails made by splitting the ends were wrapped around the knee joint above and below the patella and the tails were lapped. Then the edges of the tails were fastened together with fine silk sutures with such tension that the transplant might hug the raw surface of the joint with just enough pressure to eliminate vacant spaces between the two raw surfaces, but without being so tight as to interfere with the blood supply. I used whole skin graft about the knee joint and popliteal space. This is essential where contractures are to be avoided and where in normal use of the limb constant movement takes place. The whole skin is less vulnerable and more pliable and is not so likely to crack or chafe. About the joints and over tendons it should always be used, when possible. The remainder of the granulating surface over the leg, thigh, buttocks and groin we covered with half skin, or Thiersch graft, taken from the mother's thighs. We secured pieces about four to six inches long and an inch wide and, when possible, applied them by placing one end of the graft on the anterior surface of the leg and allowing it to fold around the leg and terminate on the posterior surface, repeating this on the other side. Thus the entire surface of the leg, thigh, buttocks and groin was covered. Care was taken to see that the two surfaces were free from intervening foreign material and that the new skin snugly hugged its new parent. No drugs or dressings for pressure, were applied direct to the new skin. A sheet was pinned about the cage. Except for the etherization the patient was none the worse for his venture. The mother's abdominal wound, from which the whole skin was taken, was accurately sutured. The half-depth denuded skin on the thighs was covered with vaseline gauze and stripped with zinc oxide adhesive plaster. The mother left the hospital in ten days all healed.

From October 13 when the grafts were placed, until November 17, one month and five days, the grafts apparently were doing well. On October 27, two weeks after the skin grafts were applied, inspection showed that all the grafts had taken except on the outer surface of the upper thigh, where the boy had got his fingers through the cage and scratched a place about two inches square, which remained denuded, and except for a place about the same size on the outer surface of the buttocks where the sheets came in contact with the grafts. At this point the cage was defective. Otherwise, it seemed that during the period from October 13th to November 17th the grafts were thoroughly established. During that time the patient was doing well in a general way, increasing in weight, with good appetite, sleeping well, and free from pain. There were dry crusts between the grafts and some exfoliation from the surface of the Wolfe grafts. There was some odor. The grafts had a pinkish color and were well anchored. There was little or no evidence of infection. For several days before November 17 it was observed that there was an increased amount of purulent-appearing fluid under the crusts between the grafts, and there was increased odor. Normal salt solution and Dakin's solution were sprayed over the surface for a day or so. With this unfavorable and nearly

seven months' old granulating surface, nothing like such a favorable result as was obtained to this date would ordinarily have been expected; and there is, it would appear, but one explanation for such a success, i.e., complete immobilization. There was no contraction of the leg; nothing had touched the grafts except at the two points mentioned; the new circulation had not been interrupted by movements either of the base or of the new skin. The failure of the graft at the two points only where there had been touching and disturbance, and its success at all other points, seems additional proof of the soundness of the principle of immobilization.

To clean the exfoliation referred to, I tried the application of small pieces of gauze wet in warm normal salt solution direct to the surface of the entire graft area, keeping the gauze moist by spraying with the same solution. At this time the patient had just a little elevation of temperature caused, presumably, by absorption of septic material from under the crusts. After two days these small pieces of moist gauze were removed, the boy crying some and complaining of pain at the time. This procedure helped to clear the surface of scabs and exudate; but it was not entirely successful and, therefore, in a few days, the same thing was repeated, with further improvement; but the crusts continued to form when exposed to the air. This application of moist gauze was repeated again on November 16 when, however, the patient's temperature increased rapidly to 103°F., and after this continued as a septic temperature. Locally the infection was increasing. The gauze was kept moist by spraying and was changed daily until the morning of November 21, but the patient's local and general condition was not improved. On November 17, in connection with the rise of temperature referred to, his appetite disappeared and there was a marked increase in the amount of discharge under and around the crusts.

On November 21, one month and eight days after the grafts were applied, a procedure was taken, one result of which teaches a most helpful lesson in respect to the process of skin grafting. The cast around the abdomen was cut and the whole immobilizing cage was temporarily removed and the boy was put into a warm tub bath. The small pieces of gauze came off the leg under the water without causing pain and we were able thereby to get a cleaner surface. But when the boy was raised up to a perpendicular position for a few moments, to dry him after the bath, blood exuded from almost the entire surface of the leg. While the warm water had probably caused some hyperemia of the leg, there was no bleeding from the surface while the patient was lying in a horizontal position in the tub. It was not until he was put into a vertical position with the leg hanging down that the bleeding commenced; and the exuding blood stopped as soon as he was put back into his bed and the cast and cage replaced and elevated as it had been for weeks. This same procedure of putting on wet gauze for a day and then placing the patient in a warm bath was repeated on November 30 with the same result of severe bleeding from the leg when a perpendicular position was taken after the bath. Again, no bleeding occurred while in the bath horizontally; and, again, the bleeding suddenly ceased when he was returned to the horizontal position in his bed with the leg slightly elevated. When the bleeding took place the blood appeared to exude through the surface of the new skin; and small hemorrhagic blebs appeared beneath the new skin. After this the whole new skin was rapidly destroyed.

By December 8 the patient was pale, septic and very sick, his hemoglobin 35 per cent. He was given a light anesthetic and a blood transfusion, and the dead skin was removed. After this he improved. His temperature dropped, and on December 11, under an anesthetic, some autografts were applied to the upper part of the thigh and these have taken well and are growing. At this writing the patient is still in the Holy Cross Hospital with the autografts growing on the upper part of the thigh and buttocks, these areas being pretty well covered.

The ocular demonstration above described shows what can happen to the circulation and to new blood vessels on the surface of an extremity through changing the position from horizontal to vertical. After skin grafting, until we know that the new skin is a substantially fixed and permanent affair, and until three weeks, let us say, have passed, the burned part of the body should not be changed from horizontal to vertical position because, by doing this, the delicate capillaries of the

new blood supply may be destroyed by the rush of blood into them and may thereby change what would have been a successful skin graft into a failure. The sudden engorgement of the new blood supply by change of position, at least after a horizontal position has been maintained for some time, seems to destroy the circulation to the new skin and thereby cause death of the graft. On December 3 the boy was again put into a warm tub, but pains were taken, in view of the lesson suggested, not to allow the leg to hang down on removal from the bath; and on this occasion there was no bleeding whatever.

It is probable, however, that in this case there were other agencies that destroyed this new skin after it appeared so well established, and after more than six weeks had elapsed. First, there was infection, or some process producing similar symptoms, as was indicated by the increase in the boy's temperature, by his loss of appetite, by his increased illness, by the increased discharge about the crusts, and by the increased odor. This infection, plus the unfortunate circumstance of allowing the leg to hang down, with the consequent rush of blood under the new skin to dislodge it from its moorings, may, together, help to explain the destruction of the new skin. The main factor, however, was the isografts. John W. Sugden, of Salt Lake City, who has seen this case with me from the beginning almost daily, who gave the transfusions, assisted in putting on the grafts and cage and aided by suggestions and helped in many ways, suggested at once that this complete desquamation after the grafts had seemingly become well established was due to the use of homologous grafts. It is believed that when homologous grafts are used only about one out of ten are successful, and that if they do take, a longer time is required and that, in many instances, the grafts apparently take at first but later undergo a change. The theory is that homologous grafts act as a foreign protein and excite a reaction similar to that of an anaphylaxis; that the grafts then undergo an aseptic necrosis and are either absorbed or separated; that contamination is present and the necrotic material and exuded serum supply culture media, true suppuration not being present.

Perthes[1] reported failures with isografts and success with autografts. Lexor[2] says, regarding isografts:

> The error of observations depends mainly upon the fact that in isografts there is a rather firm adhesion of the graft until the third week, which simulates a 'take.' If the defects are not large there occurs under the dying desquamating isograft an epithelization of the wound surface from the wound edges. This new epidermis is easily mistaken for the work of the isograft.

Lexor did not grasp the true situation, viz., that the graft really did "take" but was melted away later by some form of intoxication. Schoene[3] says:

> The primary toxic effect of tissue juices of the host upon the transplant cannot be denied. We know that the serum of a human under certain circumstances can hemolyze the red corpuscles of another. One cannot doubt but that through a similar process the success of a transplant can be frustrated . . . In addition to the injury to the transplant by the host we must recognize also an injury to the host by the transplant . . . A very important question also is in how far reactions of immunity and anaphylaxis are responsible for the failure of foreign transplants. That such reactions occur cannot be doubted.

Underwood[4] reports cases and says:

> So far as I am aware there has been no effort to identify the reaction accompanying repeated skin grafting over large areas with that of anaphylaxis, yet it seems clear that they are closely related if not identical.

Holman,[5] in an instructive article

[1] Perthes, G. *Zentralbl. f. Chir.*, 1917, xliv, 426.
[2] Die Neue Deutsche Chirurgie.
[3] Schoene, Die Heteroplastische and Homoplastische Transplantation, 1912.
[4] Underwood, H. L. Anaphylaxis following skin-grafting for burns. *J. Am. M. Ass.*, 1914, lxiii, 775.
[5] Holman, E. Protein sensitizations in isografting. *Surg., Gynec. & Obst.*, 1924, xxxviii, 100.

reviews the literature, including the quotations from Perthes, Lexor, Schoene and Underwood above. He had microscopical sections of grafts made at different periods, and, regarding one case which he reports, says:

Certainly there occurred complete epithelization of the denuded leg by rapid spread of new tissue from the grafts transplanted from the mother. Microscopical sections of these grafts demonstrated conclusively that they had "taken" and were living tissue at the time of their removal four months after their transference from the mother. That isografts will "take" is demonstrated without the slightest question, but that they may melt away subsequent to a successful "take" is also demonstrated. Our experiences with isografting, therefore, prompt us to recognize and stress a principle in isografting which has heretofore received scant attention and little emphasis, namely, the possibility of sensitizing the patient to the foreign proteins of the graft.

STRAWBERRY GALL BLADDER

It is from recent investigations on this type of gall bladder that our present day conception of cholesterol and its relation to the gall bladder, and the origin of cholesterol stones, has arisen. Boyd's study of "strawberry" gall bladders has done much to clarify our knowledge regarding the origin of this type. His histological studies have demonstrated the location of cholesterol in the epithelial cells lining the gall bladder, together with its dissemination through the walls of the gall bladder. His further chemical and spectroscopic investigations have demonstrated the probability that the yellow strawberry-like spots in this type of gall bladder lesion represent a combination of a cholesterol ester with a fatty acid, and are true lipoid deposits, correlating thus the disturbance in cholesterol metabolism with the gall bladder pathology, as seen in this lesion, commonly termed strawberry gall bladder. There seems little doubt that cholesterol stones are the result of a disturbance of cholesterol metabolism with a resulting increase of cholesterol in the bile, due perhaps to the inability on the part of the gall bladder wall to permit the passage of cholesterol through it. It is interesting to note in the pathological sections that high grades of inflammation play but a minor part in this disturbance of cholesterol metabolism, and that the cholesterol deposits of the so-called "strawberry" type tend less and less to appear, as the inflammatory process in the gall bladder wall increases. The frequency with which polypoid masses of gall bladder mucosa laden with cholesterol deposits may be demonstrated in the wall of the so-called "strawberry" gall bladder leaves little doubt but that these masses separate from the wall of the gall bladder to float free within the viscus, and are the nuclei upon which are developed cholesterin stones in a gall bladder whose bile is over-rich in cholesterin crystals. This is the type of gall bladder which often shows nothing abnormal on inspection to the surgeon when the gall bladder is exposed, but which produces symptoms which are relievable by cholecystectomy.—Frank H. Lahey in *The Boston Med. & Surg. J.*

TORSION OF THE SPERMATIC CORD*

HERBERT T. WIKLE, M.D., F.A.C.S.

BROOKLYN, N. Y.

TORSION of the spermatic cord and torsion of the testicle are comparatively rare conditions, and are practically always surgical. Those cases that have not been treated surgically and have been followed up, have revealed eventually a completely atrophied testicle. C. Moncany[1] reported a case in a ten-months-old child in which he performed a detorsion without operation, and he reports atrophy and final disappearance of the testis. Perhaps many other cases which have been relieved by detorsion without operation would show a similar final result.

What was probably the first case was reported by Delasiauve[2] in 1840. Since then Vanvaerts[3] collected 44 cases, reporting them in 1904. O'Connor,[4] in 1919, collected 124 cases. More recently Keyes[5] and his associates at Bellevue Hospital reported seven cases from the records of the genitourinary service at that hospital. Clute[6] reported 3 personal cases in 1919. Max Thorek[7] reported 1 case in 1919, and 2 in 1925. Papin,[8] Murray,[9] Powell,[10] Begg,[11] Nash,[12] Young,[13] Meltzer[14] and others have reported cases, which indicates that the condition is more frequently recognized and recorded than formerly.

A white male, aged seventeen, was awakened out of a sound sleep by acute pain in the region of the left testicle which was followed in about a half hour with nausea and vomiting. The left testicle became markedly swollen and very painful to touch. The pain was very much exaggerated when the patient tried to stand. When examined one hour later, the history revealed the fact that the patient had taken unusually strenuous exercise by fencing, nine hours prior to onset of pain, but stated that he had experienced no pain at that time, and was entirely free from pain when he retired at 11.30 p.m. No history of sexual contact, venereal infection or trauma could be elicited.

Past history negative except for an attack of scarlet fever one year previously. Tonsils and adenoids removed ten years ago. Family history irrelevant. General physical examination essentially negative. The right testicle, penis, prostate, inguinal glands, and right inguinal canal revealed no abnormal enlargements, positions, discharges, or impulses. The left testicle was about twice the size of the right, was drawn firmly against the external ring, and was very tender. The lower left abdomen was slightly rigid and tender over the external ring and for a distance of about 3 cm. above the level of the ring.

A hypodermic injection of morphine was given and an attempt was made to manipulate the testicle. The patient was free from pain the following afternoon, and the testicle was found to be in its normal location and only slightly tender and practically normal in size. The patient was up and about and experienced no discomfort whatsoever. Two days later he had a return of the pain on arising, but with this attack there was no nausea or vomiting; the pain disappeared when the patient was recumbent, and recurred only when he tried to rise. Because the patient was comfortable when lying, a physician was not called until forty-eight hours later, when the patient was found to be lying comfortable in bed. The left testicle was swollen to about twice the normal size, extremely tender, and drawn up against the external ring as before.

Seen in consultation with Sturdivant Read, the diagnosis of torsion of the spermatic cord was confirmed, and the patient was referred to the Carson C. Peck Memorial Hospital where he was operated on by Dr. Read and me.

A low left inguinal incision 6 cm. in length was made, exposing the cord, which was found to be thickened and edematous, the tunica vaginalis being markedly thickened and dark in color. The testicle was found to be swollen, containing many areas of beginning gangrene. There was 180 degree torsion at the junction of the testicle and cord intravaginally. There was also a developmental defect in the mesor-

* Read before the Brooklyn Surgical Society, October 7, 1926.

chium which apparently caused the testicle to lie in a partially twisted position normally. The epididymis was found to contain several dark gangrenous areas. The cord was then ligated near the external ring with interrupted suture-ligatures of No. 1 chromicized catgut, and cut between the ligatures. The testicle was thus removed. The wound was closed in layers, with one rubber tissue drain. The specimen was preserved for the Hoagland Museum.

The patient was discharged eight days after operation in good condition.

DIAGNOSIS

The differential diagnosis between torsion and strangulated hernia is very often most difficult, chiefly because torsion of the cord is not thought of at the time the condition occurs, as the diagnostic errors recorded in literature will bear out.

Briefly the differential points are: 1. The general symptoms of torsion are not so severe as those of strangulated hernia. 2. Vomiting is not so persistent and is never fecal, in torsion. 3. There is no evidence of flatus in the torsion tumor. 4. The bowels react to purgatives. 5. There is more shock in strangulation.

Vanvaerts has pointed out that if an epiploic strangulated hernia coexists with an ectopic testicle, differentiation from a torsion of the cord is impossible.

Acute epididymitis and traumatic condition can be differentiated by a careful history.

PROGNOSIS

In the recurrent types where the torsion is slight, a spontaneous detorsion may occur, but if the condition remains untreated, atrophy and gangrene may result. Sloughing of the tissues is very rare, although Putzu[15] in his experiments on dogs, report several instances where necrosis and sloughing occurred.

From the reported cases there is no indication that death occurs even without treatment.

TREATMENT

Orchidectomy and epididymectomy constitute the logical surgical procedure, when the diagnosis has been established; for the patients upon whom detorsion has been practiced without operation, and those upon whom testicular fixation by suture has been done, eventually have had atrophied testicle.

CONCLUSIONS

1. This patient was of the age at which the condition is most frequent, as 75 per cent of the cases occur before the age of twenty.

Fig. 1.

2. The length of time elapsing between the history of the strenuous exercise and the onset of symptoms, nine hours in this case, is unusual.

3. The condition occurred on the left side in a patient whose testicle was well descended. Of the 124 cases collected by O'Connor, 70 were on the right side, and 54 on the left.

4. The torsion was intravaginal, which is the most frequent location.

5. Of the two recognized types of torsion of the cord, acute and recurrent, this case might possibly be classed as acute recurrent.

6. Orchidectomy and epididymectomy constitute the logical treatment, particularly in the recurrent type.

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[SURGICAL SUGGESTIONS]

FOR the removal of non-malignant breast tumors the Warren incision, curved along the lower margin of the gland, is the least disfiguring approach. Through it much or all of the breast can be enucleated, if need be.

JUST as the chest should be roentgenographed for possible metastasis before operating on a bone sarcoma, so too, should chest, spine and pelvis be roentgenographed before operating on a breast carcinoma.

THE percentage of cures of breast cancer with axillary gland involvement is small. When the supraclavicular glands are involved curability appears to be nil; and in such a case operation would be justifiable only for psychic effect or to remove a breast that threatens offensive ulceration.

A LIGATURE-CARRYING TONSILLAR HEMOSTAT

ANGELO J. SMITH, M.D.

YONKERS, N. Y.

THE occurrence of troublesome hemorrhage either during or after the tonsil operation constitutes a rather common complication.

Unfortunately, no patient upon whom tonsillectomy is to be performed can ever be regarded as being exempt from the possibility of hemorrhage, and it is plainly the duty of the operator, not only to control bleeding to the best of his ability at the time of operation, but to do all in his power to protect his subject from subsequent hemorrhages.

Formerly little or nothing was done to safeguard the patient against postoperative hemorrhage, the surgeon usually relying upon his ability to meet contingencies as they arose by such means as he could command. In this, pressure applied in the tonsillar fossa, the use of drugs to constrict the blood vessels and occasionally suturing the pillars over a pledget of gauze were methods perhaps most frequently used. Such methods of controlling hemorrhage seem insecure and on the whole insufficient when compared with the more logical one in use by many nose and throat surgeons today of ligating the bleeding vessels in the tonsillar fossa at the time of operation. By this statement, I would not be understood as decrying these older methods of controlling tonsillar hemorrhage, which in spite of ligation may still be useful in certain cases, but rather would suggest that such measures should, as it were, constitute a second line of defense, something for emergency use; and seldom if ever should they be relied upon as our chief means of control.

The ligation of tonsillar vessels, however, has been difficult and has usually required a rather high degree of skill on the part of the operator, as well as the cooperation of a thoroughly trained assistant.

It seems not improbable that ligation of vessels in the tonsil operation will become a more nearly universal practice once the technique is simplified; and the ligature-carrying forceps presently to be described was designed with the intention of lessening in some measure the present difficulties.

The principle of operation of this instrument is not new. It embraces the idea of carrying a looped ligature over the point of a hemostatic forceps which clamps the bleeding vessel. When in position the loop is tightened, thus constricting the part, and as the tightening process continues the ligature is presently made to knot firmly about the vessel.

The advantages claimed for this new instrument are that it combines the hemostatic forceps and ligature carrier in one instrument, and with it the operator can ligate vessels without assistance other than that necessary to expose the field of operation.

The forceps differs in no respect from the curved tonsillar hemostats in common use. The ligature carrier is a movable rod slightly shorter than the forceps, which by means of outriggers attached to the forceps is held in position parallel to the latter. This rod has a small opening at the distal end through which the ligature is threaded, and at the outer end a groove to receive the long arm of the ligature to prevent entanglement.

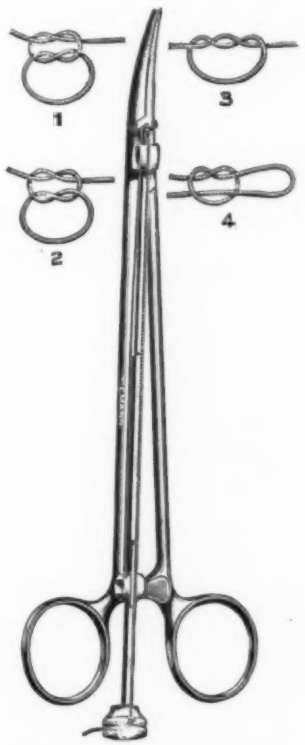
The construction of the instrument is such as to permit this rod to slide in the direction of its long axis back and forth over the face of the forceps. When drawn back the carrier locks in position and in no way obscures the tip of the forceps from view. This is the position of the carrier

when the vessel is grasped, after which by pushing in on the outer end of the carrier, it is made to glide along until the eyelet passes the tip of the forceps by approximately three millimeters. This eyelet acts as a pulley through which the ligature travels, and is of just sufficient size to permit the ligature to run smoothly without undue friction.

To arm the instrument for ligation, use a ligature about fifteen inches long and tie a reef or square knot at one end forming a loop, as in knot No. 1, about one-half inch in diameter. This loop is passed over the tip of the forceps for a distance of one and one-half inches and the long arm of the ligature is threaded through the eyelet in the distal end of the carrier in the direction away from the forceps. The carrier is next drawn back and locked, sufficient traction is made on the long arm of the ligature to close down the loop until it embraces loosely the jaws of the forceps; and to prevent any possible entanglement the long arm of the ligature is placed in the slot at the outer end of the carrier (see illustration). So simple is the process that almost any operating-room nurse can be taught by a single demonstration to thread the instrument, and little more time is consumed in threading it than is required to thread a needle.

In using the square knot, there is one precaution which should be borne in mind, viz., the knot should be tied rather loose and never should be drawn absolutely tight. It is possible to tie the knot so tight (especially if the ligature is wet) as to cause it to jam in the eyelet. However, this is an accident which with any reasonable care need never occur. Instead of using the reef knot in forming the loop, the granny knot No. 2, the double knot No. 3, or the slip knot No. 4 may be substituted. None of these, however, possesses any advantage over the reef knot and none of them seems quite as dependable when tied about a vessel.

To tie, grasp the bleeding vessel in the point of the forceps, push in the carrier as far as it will go, and while holding the carrier in this position, make traction on the long arm of the ligature, when the loop will slide down over the point of the forceps and engage about the vessel. Before the loop actually engages, the forceps should be drawn away sufficiently to put the tissues slightly on the stretch. Firm traction is now continued until the loop closes tightly. The ligature is then severed close to the point of the forceps, the carrier withdrawn and forceps released.



With this instrument, ligation of vessels in the throat can be done very rapidly and, as previously intimated, it places all the essential parts of the operation—grasping the vessels, holding the forceps, and tying the knot—in the immediate control of the operator. The need for a highly trained assistant is less imperative. There is one less instrument in the throat, which is an item of some importance, and especially so when operating with a local anesthetic. Furthermore, it is very simple of operation. After the vessel has been grasped, all one needs to do is to push

home the ligature carrier, make traction on the long arm of the ligature and it automatically ties. If the instrument is properly made and the ligature is wisely chosen, we may with all confidence expect that it will tie every time.

Any one possessing sufficient surgical skill to grasp the bleeding vessel can certainly tie it with this instrument, and with a moderate amount of experience he can grasp the vessel, tie and sever the ligature and remove the forceps easily, in from fifteen to twenty-five seconds.

The choice of ligature is important. In drawing it through the eyelet in the end of the carrier, the knot is slid along that portion forming the loop and in that manner the loop is closed. For this reason the size of the ligature must always bear a proper relation to the size of the eyelet, otherwise the knot may jam.

A six-ply linen thread (unbleached) having a tensile strength of ten pounds has proved so eminently satisfactory as to seem to warrant unqualified recommendation.

One very quickly accustoms himself to the use of this instrument but the beginner may very well spend a few moments tying knots around bits of cotton in order to acquaint himself with its operation before attempting to ligate vessels in the throat.

NEPHROLITHOTOMY

In cases of calculus the kidney, pelvis, and ureter are freely accessible for palpation, and the stone is usually quickly and easily found. Only when a single calculus lies freely in an aseptic pelvis do I remove it by pelveotomy. As a rule, I perform nephrolithotomy in the following manner: I hold the stone between the thumb and index finger of the left hand, while I make an incision in the capsule on the conveity of the kidney over the site of the stone with a small knife; then with a Lister forceps I work my way bluntly through the kidney tissue on to the stone, and while withdrawing the Lister forceps dilate the incision so that I can now introduce a suitable calculus forceps and extract the stone or stones. My method has the great advantage over the ordinary one—splitting the kidney with a knife—that the urine canals and the blood-vessels are not cut through, but without any damage of note are bluntly separated from one another along the natural lines of cleavage of the tissues. In this way hemorrhage from the kidney parenchyma is avoided both during and after operation, which otherwise so frequently complicates nephrolithotomy in a dangerous manner, and this is best illustrated by the fact that three such excellent surgeons as Marion, Mayo, and Nicholich each has to do a secondary nephrectomy in 10 per cent. of his cases.—Thorkild Rovsing in *The Practitioner.*

TRANSACTIONS OF THE
SECTION OF GENITO-URINARY SURGERY
NEW YORK ACADEMY OF MEDICINE
Meeting of March 16, 1927
THE CHAIRMAN, DR. FREDERICK T. LAU, PRESIDING

UNILATERAL RENAL APLASIA

DAVID W. MACKENZIE, M.D., AND ALLAN B. HAWTHORNE, M.D.
Department of Urology, Royal Victoria Hospital
MONTREAL

THE condition which we wish to discuss is that of renal aplasia, or defective development of the kidney. It is one that is of interest from the point of view of embryology, and also, as an anatomical variation.

The functionless kidney is of general interest to the surgeon and internist, but it is of special interest to the urologist, and for this reason, we wish to present six cases which we have had in the urological service of the Royal Victoria Hospital.

These cases are all in the class of developmental defects; and we do not intend discussing such other causes of functionless kidney as tuberculosis, calculus or a closed pyonephrotic lesion.

Of the six cases, five are living, and we also had the opportunity to examine clinically the other case before death.

In the series there is a range from complete absence, in one case, to that of hypoplasia in two others. When we look at the embryology for a moment we can see that there is ample room for such variation in the rudimentary organ.

In complete absence there is evidently a lack of formation of the renal bud from the Wolffian duct. This condition of complete absence is reported by Anders to be present in about 1 case in 1800, and by Motzfeld as 1 case in 1000. Some 350 to 360 cases reported in the literature and from our series we can add one to the list.

Many of these cases show some abnormality in the genital tract and Moore states that "in 75 of the 226 cases examined, or 33 per cent, more or less extensive congenital defects of the genital organs are recorded."

In these cases in the male there is evidently a defect in the formation of the Wolffian duct itself, and in the female an associated defect in the Muellerian duct.

A defect at a later period in embryonic life would bring about the condition frequently seen in cases of absent kidney: that of normal genital formation with a normal bladder and ureteral orifices, but with a short rudimentary ureter, which may or may not be patent.

This condition is fairly frequent. Quoting Anders again, he states that "Out of the whole number or 286 cases reported, the ureter was completely absent in 240 cases. In 24 instances a more or less rudimentary ureter was in evidence without the slightest indication of the presence of renal structure." The defect in this latter instance would, no doubt, be due to lack of development of the nephrogenic tissue, the precursor of the secretory portion of the kidney, associated with a defective development of the ureter bud, and the failure

of division into primary and secondary tubules.

In some of these cases a mass of connective tissue has been found in the region where the kidney should normally lie, but no mention has been made of the findings of any evidence of renal tissue (Lewis, Gilmore).

It is reasonable to suppose that this defective development, whatever it may be due to, could occur at a slightly later period in embryonic life and leave some traces of fetal or partially developed renal tissue not forming in any way what could be called, anatomically, a kidney.

Three of our cases are of this type. A defect arising at a later period would leave a more perfectly formed kidney, which may or may not function. These are of the type classified as hypoplasia. Many such cases have been reported in the literature, and two in our series would fall in this class.

This defective development has been considered by Coplin to be due to defective arterial development, coinciding probably with the work of Bagg on congenital defects on roentgenographed mice. Bagg has given many instances of absent and rudimentary kidney following this method. In some cases the rudimentary kidney was no larger than the head of a pin, while in many it was completely absent.

Whatever may be the anatomical findings in each individual case, each one is non-functioning, and the diagnosis of such a condition is of extreme importance to the urologist, if, under the stress of carrying on all the excretory function, the sole kidney becomes damaged whether by nephritis, calculus or infection. Ballowitz stresses the frequency of calculus formation in the solitary kidney while the combined statistics of Ballowitz, Moore and Anders indicate that a greater than the normal percentage among subjects of congenital single kidney die of kidney complaints. Anders also found that in 42 per cent of the cases in his series, the single kidney showed advanced lesions of chronic nephritis.

Throughout this discussion we have used the term *aplasia* to mean incomplete development. This we believe would also include both the absent and the rudimentary kidney, the differentiation being only a matter of degree.

The cases which we have to report are as follows:

Case 1 (59124). Mrs. P. L. aged nineteen years, was admitted to the hospital July 16, 1926, suffering in the right lumbar region from pain of four days duration. The attack had commenced with aching pain in the right lower quadrant of the abdomen, followed shortly by similar pain in the right lumbar region, and more acute attacks radiating down the right leg.

The following day the patient developed fever, chills and diurnal micturition every half hour—voiding small quantities with a marked burning sensation.

She gave a history of right-sided pain with fever and chills during her first pregnancy three years previously, but had no such symptoms during the second. She was admitted to the hospital on the day following the onset of her symptoms, and on examination appeared to be in great pain, with frequent rigors and a temperature of 103°.

There was marked tenderness in the right costolumbar angle, also over the whole right side of the abdomen. The right kidney was easily palpable, enlarged, firm and tender. The left kidney was not palpable nor tender. There was no abnormality of the external genitalia. The urine was cloudy, straw-colored, 1010 sp. gr.; acid; albumin +; sugar, none; microscopically: epithelial cells, motile bacilli, pus ++, but no red blood cells or casts.

1 c.c. of phenolsulphonphthalein, intramuscularly, gave: 10 per cent, first hour; 25 per cent second hour; total, 35 per cent.

On cystoscopy the bladder mucosa was found to be slightly inflamed. The right ureteral orifice was normal in position and appearance, but the left was not made out. The right ureter was catheterized to the renal pelvis, and a specimen was obtained which showed microscopically: epithelial cells; pus ++; few red blood cells and colon bacilli. Roentgenograms with catheter in the right ureter showed the tip of the catheter at the level of the third lumbar vertebra. No shadow was made out which would suggest calculus. A large right

kidney shadow was noted, with no evidence of any kidney shadow on the left side.

The condition remained unchanged, with a temperature ranging between 104° and 105°. The following day a decapsulation and nephrotomy was performed. It was noted then that the kidney was approximately double the size of a normal kidney. No abnormality of vessels was noted. The patient was discharged three weeks later with the wound healed and the renal function improved, as shown by the phenolsulphonphthalein test (1 c.c. intramuscularly), giving 40 per cent the first hour, and 30 per cent, the second—total, 70 per cent for two hours.

She was readmitted two months later still troubled with pain on the right side, some tenderness over the bladder, and a diurnal frequency of five to six times; nocturnal urination once, accompanied by burning sensation.

This time there was tenderness in the right costolumbar angle, and the right kidney was enlarged, firm and tender. There was slight tenderness along the course of the right ureter and over the bladder. The urine was clear; straw-colored; sp. gr. 1010; acid; a faint trace of albumin was present, but no sugar. Microscopically there were scattered pus cells and some epithelial cells. The renal function by the phenolsulphonphthalein test (1 c.c. intramuscularly) gave: first hour, 50 per cent; second hour 20 per cent; total, 70 per cent for two hours. The blood findings were normal:

Blood urea	.420 gm. per liter.
Blood urea nitrogen	19.6 mgm. per 100 c.c.
Creatinine	1.29 mgm. per 100 c.c.

Cystoscopy at this time showed the bladder mucosa to be slightly inflamed and granular. The right ureteral orifice appeared normal. The left could not be found; in fact there seemed to be an absence of the trigonal ridge on that side. The right ureter was catheterized to the renal pelvis and clear amber urine was obtained, containing a few red and white blood cells. Culture of this specimen gave no growth. A pyelogram with 4 c.c. of 12 per cent sodium iodide solution in the right pelvis showed a very large kidney shadow, with only a partly filled large renal pelvis. Indigo carmine injected intravenously appeared from the right side in two and a half minutes but none appeared from any portion of the left side of the bladder or urethra.

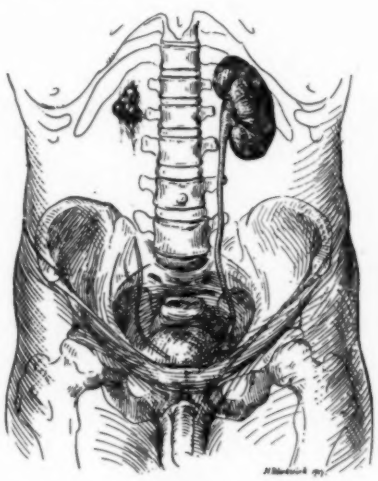


Fig. 1.

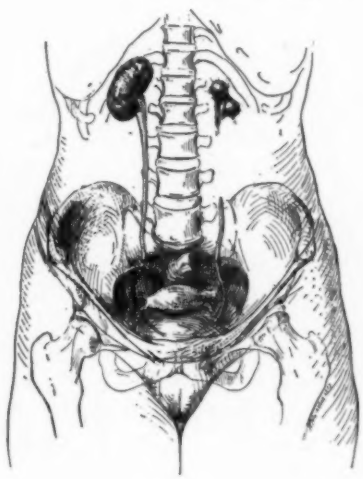


Fig. 2.

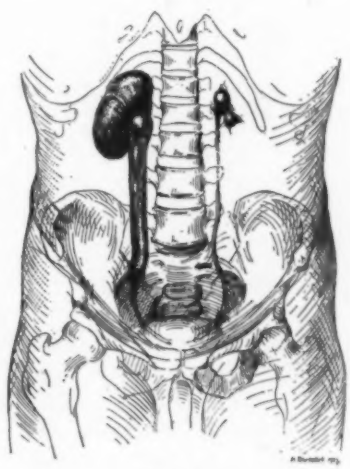


Fig. 3.

Fig. 1. Schematic drawing showing nodules of rudimentary renal tissue in right kidney region of Case II. Nodules connected by fibrous bands. Lower portion of ureter patent to sacroiliac synchondrosis. Upper portion not found at operation.

Fig. 2. Schematic drawing showing two cysts connected by fibrous bands in Case III. Lower portion of ureter patent, upper portion absent.

Fig. 3. Schematic drawing of Case IV showing nodules of aplastic kidney tissue in left renal region. Lower portion of ureter patent, the upper represented by a fibrous cord connected with these nodules. Stricture in lower portion of right ureter with hydroureter and hydronephrosis.

Case. II. H. W., male, age thirty-one years admitted July 30, 1925 complaining of a urinary frequency from which he had suffered for two years. Four days previously he had an attack of colicky pain on the right side and

from that time on he had burning on urination. He gave no other history or symptoms. As a child he had had infantile paralysis, scarlet fever, mumps and chicken-pox. His general examination was negative apart from some atrophy of the left leg and paralysis of muscles below the knee. The blood pressure was 120/80.

Examination of the genitourinary system showed no costolumbar tenderness; the kidneys were not palpable; there was slight ureteral tenderness on the left side but none on the right. There was no suprapubic tenderness or distension. External genitalia and prostate were normal. Urine was clear, straw-colored, 1020 sp. gr., and some albumin was present, but no sugar. Microscopically there were present pus positive, motile bacilli, epithelium, and calcium oxalate crystals.

Renal function tested by phenolsulphonphthalein intramuscularly given, was apparently normal: the first hour, 55 per cent; the second hour, 15 per cent; total 70 per cent in two hours. Wassermann blood reaction negative. No tubercle bacilli were demonstrated in the bladder urine on several examinations.

Roentgenography of the kidney and bladder region showed a small round shadow opposite the fifth lumbar vertebra on the right side.

At cystoscopy the bladder mucosa was found to be slightly inflamed. The ureteral orifices, in normal position, appeared slightly gaping. The left ureter was catheterized to the renal pelvis and a specimen obtained. The right ureter could be catheterized for only half the distance and no specimen was obtained. That from the left showed an occasional red and white blood cell, and a few epithelial cells, and culture gave a growth of Bacillis coli with communis. Roentgenograms, catheters in position, showed the left catheter up in the renal pelvis but the right only at the sacroiliac synchondrosis. No shadows were seen suggestive of calculus or of the previously noted shadow. A secondary cystoscopy confirmed these findings, also indigo carmine injected intravenously appeared from the left side in five minutes but none from the right in fifteen minutes.

The diagnosis was made of a probable closed tuberculous lesion of the right kidney, and operation was performed on August 6, 1925. On exposing the right kidney only a small mass of fat and fibrous tissue was found, containing several small nodules of a firmer tissue. Attached to these were several small blood vessels. No ureter could be found. The mass of tissue was removed from a small indefinite pedicle. There was no other evidence of kidney tissue.

Dr. Waugh of the Pathological Department reported: Specimen consists of a mass of reddish tissue, of rubbery consistence, about 30 gm. in weight. At one end is a cyst with a smooth pale wall. It is the size of a small walnut. Sections of the tissue show it to be made up of an irregular mass of loosely arranged fibrous connective tissue containing numerous larger and smaller blood vessels. There are occasional peculiar, duct-like structures, containing blue-staining, more or less homogeneous material, and lined by small irregular cells, having little resemblance to epithelium, probably atrophic, degenerated and necrotic undifferentiated lining. The cyst wall consists of wavy, fibrous, connective tissue, without epithelial lining. Hyaline fusion of the fibrous connective tissue is occasionally seen. There is no evidence of inflammatory changes in the tissue. Diagnosis: aplasia of kidney.

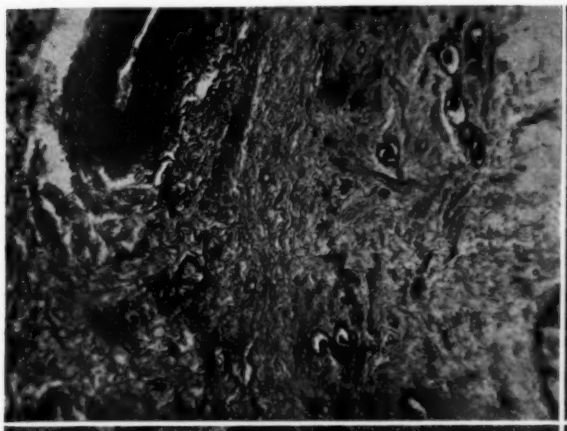
The patient developed bronchopneumonia about ten days after operation but soon recovered. When heard from six months later he was free from symptoms, had gained in weight and strength, and was able to go about his work as usual. He has had no recurrence of pain on the right side since his operation.

CASE III. Mrs. D. F., aged thirty-three years, was admitted to hospital complaining of severe pain in the left loin which had awakened her from sleep four days previously.

Diurnal frequency, five or six times; nocturnal frequency once, had appeared two days later. Slight burning accompanied urination. She gave the history of having had an attack of acute pyelitis on the right side, four years previously, and had suffered from a slight dragging pain on that side for the past six months. She had one child, ten years of age, alive and well.

On examination her general condition was normal. B.P. 120/70. Examination of the urinary system revealed no costolumbar tenderness. The kidneys were not palpable and there was no tenderness over the kidneys nor along the course of the ureters. There was no suprapubic distension or tenderness. The genitalia were normal, externally and by vaginal examination. The urinalysis showed urine of a hazy straw-color, sp. gr. 1028; acid; no albumin or sugar present. Epithelial cells, a few white blood cells and a few motile bacilli were present. No

Fig. 4.



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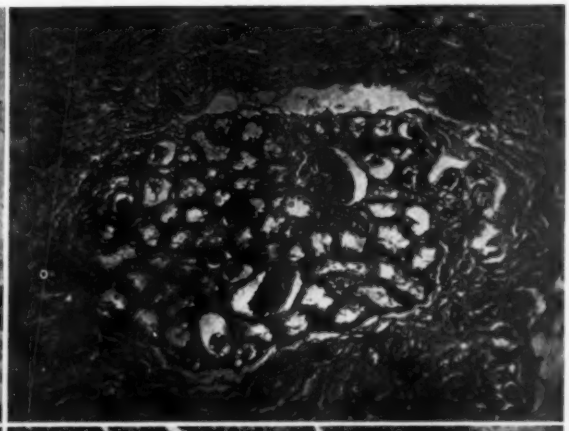

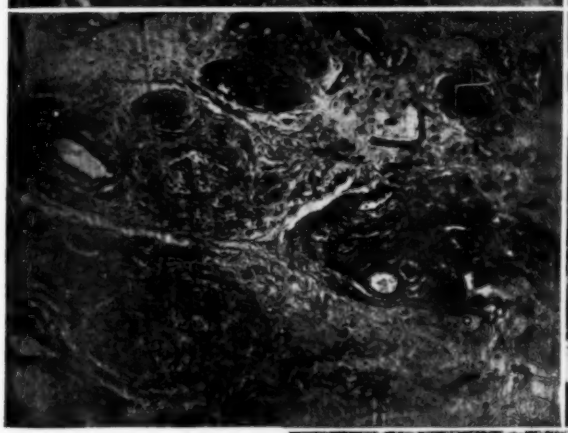

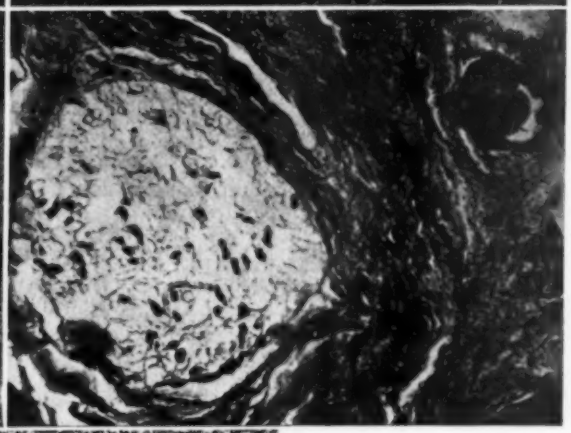

Fig. 6

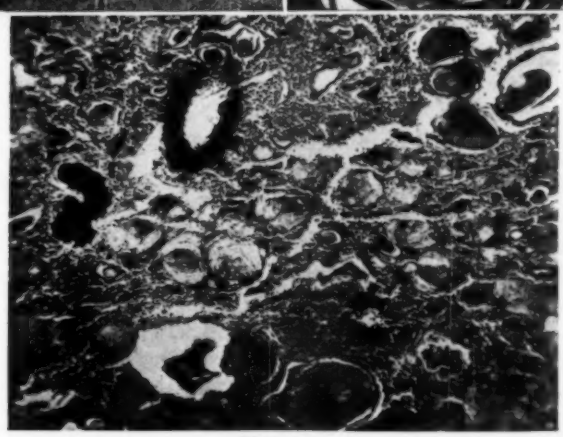

Fig. 7.

Fig. 8.

Fig. 4. Case II. Rudimentary uriniferous tubules in a mass of connective tissue. The cells are flattened and several of the tubules contain casts. A thick-walled vessel is seen in the other portion of the section. No glomeruli are found in this specimen. (Low power.)

Fig. 5. Photomicrograph of section from cyst wall in Case III. Connective tissue predominates, with here and there nests of partially and completely developed tubules and glomeruli. Several of the tubules contain casts. (Low power.)

Fig. 6. Section from nodule in Case IV showing a matrix of connective tissue and several nests of rudimentary tubules with flattened epithelium. Several glomeruli are present, overgrown by fibrous tissue. (Low power.)

Fig. 7. Photomicrograph from aplastic kidney in Case V. Showing glomerulus and one tubule enclosed in connective tissue. Glomerulus has been invaded with connective tissue which has undergone hyaline degeneration. Lumina of tubule contains an albuminous cast. (High power.)

Fig. 8. Photomicrograph of section of tissue from aplastic kidney in Fig. 9, showing the hyaline remains of glomeruli, with a few dilated tubules containing casts. There is a generalized round cell infiltration of the connective tissue. (Low power.)

tubercle bacilli were found in the bladder urine. Roentgenograms of kidney and bladder region were negative for calculi.

One c.c. phenolsulphonphthalein intramuscularly gave 65 per cent in two hours. The blood Wassermann reaction was negative. The blood findings were normal:

Blood urea..... .288 gm. per liter
Blood urea nitrogen 13.4 mgm. per 100 c.c.
Creatinine..... ... 1.29 mgm. per 100 c.c.

At cystocopy the bladder mucosa was normal. The ureteral orifices were normal in appearance, shape and position. The right ureter was catheterized to the renal pelvis and a specimen obtained. The left catheter was obstructed in the lower ureter and no specimen was secured. The right specimen showed cloudy straw-colored urine containing a few red and white blood cells and some epithelial cells. Roentgenograms with catheters in position showed the right catheter in the renal pelvis at the tip of the third lumbar vertebra. The left was at the sacroiliac synchondrosis, but no shadow of a calculus was seen.

A second cystoscopy confirmed these findings. A ureteropyelogram was attempted on the left side but no shadow of iodide fluid was seen. Indigo carmine injected intravenously appeared from the right side in four minutes but none appeared from the left in fifteen minutes.

The condition was thought to be an advanced left renal tuberculosis and operation was performed. On opening the left loin a small mass of tissue was seen in the kidney bed. This consisted of several rounded cyst-like bodies, one the size of a plum, the other much smaller. No ureter could be made out. The pedicle consisting of several small vessels, was ligated and the mass removed. The two cystic masses were connected by fibrous tissue bands. Incision of the cysts revealed a more or less viscid fluid, dark amber in color, about 15 c.c. from the larger and 5 c.c. from the smaller. This fluid showed upon examination approximately the same findings for urea, etc., as blood:

Urea.....360 gm. per liter
Urea nitrogen.....16.80 mgm. per 100 c.c.
Creatinine.....1.59 mgm. per 100 c.c.
Sugar.....093 per cent

Examination of tissue removed showed it to be irregular, dense and fibrous, with areas of hyaline fusion containing nests of poorly developed tubules, the lining epithelium of which was swollen so that its differentiation was lost, the lumina filled with hyaline casts. Glomeruli were rare and the capillaries in Bowman's capsule disintegrating. Sections of the cyst wall showed it to consist of a thin capsule of fibrous connective tissue having an inner margin of flattened epithelial cells. Diagnosis: aplasia of kidney with multiple cyst formation of rudimentary tubules. The patient has much improved, gained 40 pounds in weight, and been free from symptoms since operation.

Fig. 9. Aplastic left kidney and hydroureter removed from Case VI, a boy nine years of age. Ureter enormously dilated and tortuous, with narrow stricture at junction with bladder. Kidney is a shell of connective tissue containing a few glomeruli and rudimentary tubules.

Case IV. Mr. D. St. G., aged thirty years, was admitted on May 27, 1926, complaining of anuria of four days duration. He had been suffering from slight attacks of pain in both loins for the two previous years. These attacks were accompanied by some burning on urination. He had a slight attack of pain in the right loin, radiating down to the groin shortly before the onset of the anuria. History apart from this was negative.

On admission the patient appeared in evident distress though there was no vomiting or nausea and no edema of face, hands or feet, and mentally he was quite clear. The tongue was coated and dry. The eye grounds were normal. General examination was negative. B. P. 110/75.

Examination of the genitourinary system revealed no costolumbar tenderness. The kid-

neys were not palpable, though there was slight tenderness in the left loin in bimanual palpation of that side. No masses were palpable in the loins. There was no tenderness along the course of either ureter, and no suprapubic distension. The penis was normal in conformation. No discharge was present. The urethra easily admitted No. 16 soft rubber catheter but no urine was obtained from the bladder. The scrotum and contents were normal. Prostate, per rectum appeared normal to the examining finger. Roentgenograms of kidney and bladder region did not show any shadow which would suggest a calculus.

Blood findings at the time were:

Blood urea.....1.42 gm. per liter
Blood urea nitrogen...66.36 mgm. per 100 c.c.

He was treated symptomatically, heat to the loins, electric baker and intravenous salines of 10 per cent glucose. The following day he had not voided and was cystocoped. The bladder was empty but symmetrical, the mucosa normal. The ureteral orifices were normal in contour and position. The right ureter was catheterized for a distance of about 4 cm. when definite obstruction was met. The left ureter was catheterized for about 15 cm., when definite obstruction was met. No specimens of urine were obtained. Roentgenograms showed both catheters in the relative positions mentioned, but no shadows were seen suggestive of calculi. No clearly defined kidney shadows were seen. The cystoscopy was repeated the following day but with the same negative results.

On the morning of May 31, he had still not voided any urine, and it was seen that his condition was critical. He had become nauseated and was vomiting all fluids taken. He had become edematous and was also somewhat cyanosed and dyspneic. An operation was indicated as the last possible means of relief, as he had not voided for seven days.

His blood figures at this time had risen to:

Blood urea.....2.076 gm. per liter
Blood urea nitrogen...97.08 mgm. per 100 c.c.

In view of the history of pain on both sides and the slight tenderness noted on the left side at examination, that side was opened first. On opening the left loin the tissues were markedly edematous, as were all the body tissues. No perirenal capsule was found, and no kidney. In the region where the kidney should be there was a small mass of fat and fibrous tissue containing several rounded masses of firmer tissue. Several small vessels entered this, forming a pedicle. From this mass also a fibrous cord ran downwards toward the bladder. This mass of tissue was removed.

The right loin was then opened and a slightly larger than normal kidney found. The surface appeared slightly granular, and was a darker red than usually seen. The pelvis and ureter were markedly dilated, and the wall of the ureter, much thinned out. An opening was made at the ureteropelvic junction and a large quantity of clear, pale urine escaped. A bougie was then passed downwards, and met with obstruction in the pelvic portion of the ureter. This was overcome and a No. 12 bougie was passed to the bladder. A tube was then inserted in the opening in the pelvis for drainage.

His condition improved immediately upon the establishment of drainage. He drained a large quantity of urine from the loin for two weeks, when, after dilating the right ureter to No. 9 F. the patient voided and several days later the wound became dry. The urine passed was pale and of a low specific gravity: 1008–1010. There was some slight infection with colon bacilli, following the operation. The small specimen removed from the left side was examined by Dr. T. R. Waugh of the Pathological Laboratory; his report is as follows:

Specimen consists of some fat tissue in which are a few filbert sized masses of firmer tissue. Section shows irregular masses of fat cells connected by a loose fibrous stroma. In some areas are irregular tubular spaces lined by a regular layer of cuboidal epithelial cells. These large pale cells appear of the embryonic type, and the arrangement resembles the anlage of convuluted renal tubules. There are also tufts of cells resembling glomeruli containing red blood cells. There is a dense fibrous tissue stroma surrounding these structures and numerous thick walled vessels are seen. There is no related definite kidney parenchyma, although metanephritic blastoma with tubular and glomerular formations are found. Diagnosis: aplastic kidney. Congenital malformation of metanephros.

The patient when seen in October, 1926, had gained in weight and strength. He was free from symptoms but his urine was still of low specific gravity and there were scattered pus cells and colon bacilli in the urine.

Blood urea..... 175 gm. per liter
Blood urea nitrogen... 35.3 mgm. per 100 c.c.

When seen again in January 1927, his urine still contained scattered pus and was of low specific gravity. Phenolsulphonphthalein tested 20 per cent for 2 hours.

Blood urea..... .660 gm. per liter
Blood urea nitrogen... 30.8 mgm. per 100 c.c.

The right ureter easily admitted a No. 6 catheter, and there was no hydronephrosis.

Case v. Mrs. E. M., aged forty years, was admitted first in 1914, suffering from incontinence of urine following a birth trauma, which had occurred in 1913. She had complete incontinency of urine. Her general examination was negative, the blood pressure was 146/88.

Cystoscopy showed a small bladder containing about one ounce of thick creamy pus. The mucosa was inflamed. There was a large opening towards the right side on the floor, communicating with the vagina. The left ureteral orifice was normal. This was catheterized and normal urine obtained. No right ureteral orifice could be demonstrated, and indigo carmine injected intravenously appeared from the left ureter but not from the right side, nor from any portion of the right side of the bladder. A plastic operation was performed. This was successful for some months, but incontinence reappeared.

It was found on the next admission that a small fistula from the bladder communicated with the cervix and a hysterectomy was performed. Examination of urine from the left kidney showed at this time some evidence of infection. She was admitted in 1920, suffering from fever, chills and pain on the left side and also incontinence of urine. A small vesicovaginal fistula was present. Cystoscopy and catheterization of the left ureter showed an infected hydronephrosis. Roentgenography with the catheter in place showed a marked kink in the lower left ureter, with the catheter coiled downwards towards the iliac crest. Evidently a stricture which had resulted from trauma at the time of the hysterectomy.

She was again admitted in 1923 in uremia, and died shortly after admission.

Examination showed a large distended pyonephrotic sac on the left side, with the lower portion of the ureter narrowed and bound down in a mass of scar tissue. Examination of the right kidney showed a small mass of kidney tissue about the size of an almond, covered with a thick fibrous capsule. The pelvis was small but the ureter appeared about the normal size. About 3 or 4 cm. from the bladder it was completely stenosed and became lost in a mass of scar tissue about the bladder. Microscopically the kidney appeared to be made up of a mass of fibrous tissue with a few small blood vessels showing hyaline degeneration of their walls. An occasional tubule with flattened epithelial lining, and a few glomeruli, which had undergone invasion by fibrous tissue, were seen scattered throughout the fibrous tissue of which this was mainly composed.

Case vi. L. M., a boy of nine years, was admitted May 5, 1924, complaining of frequency by day, of five to six times and cloudy urine; which had been noted by parents for the past three years. He had also suffered from enuresis since childhood.

On examination he appeared to be well developed and nothing abnormal was noted. B.P. 108/65. The genitourinary system on examination showed no costolumbar tenderness, the kidneys were not palpable. There was no ureteral tenderness nor tenderness or distension of the bladder. His urine was cloudy amber, 1020, sp. gr., acid, albumen positive, no sugar. Microscopically it showed pus +, a few red blood cells and a few cocci. No tubercle bacilli were found in the bladder urine. The phenolphthalein test, 1 c.c. given intramuscularly, showed 30 per cent the first hour and 22 per cent the second, total 52 per cent.

Roentgenography of the kidney and the bladder region did not show any shadow suggestive of calculus. Cystoscopy showed a rather tight anterior urethra, No. 18 F cystoscope used. The bladder was symmetrical, the mucosa was slightly inflamed. The right ureteral orifice was normal. The left ureteral orifice was scarred and gaping and the left ureter could not be catheterized. Normal urine was obtained from the right side.

From the age of the boy, the frequency and the condition of the ureteral orifice a diagnosis of probable tuberculous kidney was made and operation performed. At operation the left kidney was found to be small, scarred with a slightly distended renal pelvis and a markedly dilated and tortuous ureter filled with purulent material and adherent to the surrounding tissues. The kidney and ureter were removed with difficulty. The kidney was a thinned out fibrous sac surmounting the dilated pelvis and ureter. Microscopically it showed a thin wall made up of fibrous connective tissue, a few small blood

vessels and the hyaline remains of many glomeruli. A few tubules were also noted.

The patient made an uneventful recovery. He has since gained in weight and, apart from one attack of hematuria 6 months later from the ulceration about the left ureteral orifice, has been free from symptoms.

An analysis of these six cases might prove of interest. As to sex, the numbers are equal, there being three of each. The ages are, nine, nineteen, thirty, thirty-one, thirty-three and forty years.

The left kidney was involved in 4 out of the 6 cases, and the right in 2 cases. This agrees with the majority of cases reported. Out of a short series of 18 cases collected by Goldstein, the left side was involved in 13, and the right in 5 cases.

The symptoms which compelled these patients to seek advice were usually on the side of the remaining kidney, although three of these had definite pain on the side of the aplastic kidney, and in Case II, the pain was confined solely to that side.

The frequency, burning and pyuria were in all but one case, due to infection of the solitary kidney. In Case VI, the symptoms were evidently due to the infection of the large distended ureter on the side of the aplasia. In Case I, the solitary kidney was the seat of an acute pyelonephritis, and there was a history of an attack of pyelitis three years previously during pregnancy. The kidney in the case was about twice normal size, as shown by roentgenograph and operation.

In Case II, the remaining kidney was the seat of a low grade chronic pyelitis, as shown by a few white cells at cystoscopy, and a positive culture of Bacillus coli communis. No enlargement of this kidneys was made out by roentgenograms. In Case III, the patient had suffered from attacks of pyelitis on several occasions. The kidney shadow was not shown by roentgenograms to be enlarged.

In Case IV, there was a period of anuria of seven days, and at operation a slightly enlarged right kidney with a dilated pelvis and ureter were found. There was a stricture of the ureter present in its lower third. A similar case was reported by Eisendrath several years ago.

In Case V, the renal aplasia was considered during the examination for the relief of vesicovaginal fistula, and verified at autopsy. The remaining kidney was the seat of infection, and following the trauma to the ureter and the resulting stricture, a large pyonephrosis developed.

In Case VI, the remaining kidney appeared normal in size and function.

There were no associated genital abnormalities in any of these cases.

The bladder was symmetrical in 5 cases. Case I showed an absence of the left ureteral orifice and the left half of the trigonal ridge. The bladder was inflamed in 5 of the 6 cases, which could be explained by the acute infection above. The right ureteral orifice was not seen in Case V. Whether this was damaged at the time the vesicovaginal fistula was incurred is a question. A stricture of the lower ureter was present in that case, and the terminal inch or so was lost in a mass of scar tissue. The ureteral orifices in the remaining cases, were in the normal situation. In Case VI, the left orifice was scarred and gaping, evidently a lesion of inflammatory nature. The ureter in these cases on the side of the aplasia varied. In Case I, there was no evidence of ureteral orifice in any region of the bladder, urethra or vagina.

It is reasonable to suppose that the ureter and kidney are completely absent, though Lyons reports a case in which a short rudimentary ureter was attached to the bladder in the normal position, though there was no ureteral orifice present. In Cases II, III and IV, there was a short rudimentary ureter present, patent for some distance. In two cases it ended blindly, but in the third it was continued as a fibrous cord attached to the aplastic kidney tissue, found in that region. In Cases V and VI there was a ureter present throughout, dilated, thickened and filled with purulent material, each strictured in its lower portion.

A small renal pelvis was found in these last two cases, with thickened fibrous walls. No pelvis was found in Cases II, III or IV.

Evidences of renal tissue on the side of the aplasia were found in 5 cases. There is no reason to expect any evident traces of renal tissue in Case I, many such similar cases have been reported in the literature, such as those reported by Goldstein, Bugbee and Lossee, Eisendrath and others.

In each of Cases II, III and IV, there was found a small mass of fat and connective tissue, containing nodules of firmer tissue, and in two, small thin-walled cysts. These nodules and cysts were connected by bands of fibrous tissue. They were supplied by one or more small blood vessels, and in one the fibrous cord passed downwards to become attached to the lower and patent portion of the ureter. Section of the nodules of tissue showed a predominating connective-tissue matrix, containing nests of cells, epithelioid in character, and in many instances forming ducts, the lumina of some containing albuminous material resembling casts.

In other portions rudimentary glomeruli could be made out. These were as a rule very few, and many were replaced by fibrous connective tissue, which in places showed hyaline degeneration.

The cyst wall was lined by flattened epithelium and made up of connective tissue fibers. The contents of the cyst in Case III showed it to contain urea, creatinine and sugar in the proportion similar to that found in blood.

In Cases V and VI, there was found a definite pelvis with a shell of tissue surrounding it, composed of connective tissue, tubules, and a few glomeruli, many of which had been replaced by fibrous tissue. Whether these two cases are aplastic in origin or whether they are the result of secondary atrophy is a question not easy to answer. A case similar to Case VI has been reported by Krotoszyner.

The differentiation between renal aplasia and secondary atrophy is difficult to decide histologically. Kaufmann's Pathology states "there is no essential difference in the histological picture."

Oertel is of the opinion that in a secondary atrophied kidney, there is usually some evidence of a ureter and a pelvis being present.

In all probability Cases V and VI could fall into this atrophic class; but whether the atrophic process commenced in a kidney which was normal or hypoplastic in nature is impossible to say.

Hinman's work as well as that of Barney and of Scott tend to show that ligation of the ureter causes a hydronephrosis, rather than an atrophy, so that one is reasonable in assuming that these two latter cases are congenital in origin.

Conclusions to be drawn from this series, are that:

1. Unilateral renal aplasia is not uncommonly seen in urological practice.

2. The lesion appears to be more common on the left side.

3. There is usually a lesion of the opposite or remaining kidney.

4. There is sometimes unexplained pain on the side of the aplasia.

5. The operation and removal of the rudimentary kidney, relieved pain in two of these cases, for some unexplained reason.

6. In some case nodules or cysts containing renal tissue are found, without pelvis or ureter formation.

7. The aplastic kidneys in this series were all functionless.

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Discussion

Dr. E. L. Keyes: The paper is extraordinarily illuminating to me, for it covers ground that my previous experience has not included. The writers speak of relieving pain from these aplastic kidneys but give no theories as to what caused the pain or how it was relieved. The report encourages us to operate on such kidneys, when without the information from this contribution we would feel hesitation in supposing we could do any good for them.

Dr. Paul Klemperer (by invitation): I brought a few specimens illustrating the subject of the paper. One specimen is from a male baby that died two days after birth. Aside from the malformation of the kidney there was an anomaly of the esophagus which was the immediate cause of death. In this case there is complete aplasia of the right kidney. The suprarenal glands are perfectly normal on both sides. The left kidney is normal. On the right side there is no kidney and no renal artery. Within the bladder are seen two ureteral openings, in the midline, one opens into the normal ureter, and the other into a short blind pouch.

The other specimen comes from a female baby of three weeks, born at full term. The right ureter is narrower than the left, but opens into the bladder. In place of the right kidney there is a body smaller than the left kidney composed of cysts and renal tissue. It is a hypoplastic polycystic kidney. Histologically, the remaining part of the renal tissue shows glomeruli and collecting tubules surrounded by a mantle of connective tissue. A satisfactory explanation of this case is difficult.

The third specimen, which may be of particular interest for the surgeon, is a true hypoplastic kidney from a young woman of twenty-six years. The left kidney weighs only 40 gm., the right 120 gm. The left kidney shows only three pyramids whereas the other shows six. The last case illustrates the differences occasionally arising in the aplastic and hypoplastic kidneys. The diagnosis was tuberculous aplastic kidney. I have some doubt of the diagnosis because we found a perfectly normal large renal artery on this side; therefore, I would rather consider it as an atrophy of the kidney.

I would like to touch in a few words on the mechanism and development of the hypoplasia. Any attempt to explain the abnormality of the kidney hypoplasia or aplasia has to be based on the modern explanation of renal development. The kidney, as you know, develops from two different portions, the ureter bud and the nephroblastema; only after the proper union of these two portions is the definite kidney formed. If the union does not occur no kidney is formed and there is an aplasia of the kidney. It is plausible that during the embryonal development an interference in the union may occur at various periods of intrauterine life and that may explain the various gradations from complete aplasia to mere hypoplasia. In the first specimen there was only a ureteral pouch but no ureter was found. In other cases the lower ureter may be formed which passes higher up into a thin cord in the region of the kidney. In other observations we find the ureter growing up to the level of the kidney but instead of a kidney a body in appearance like a date or a bean is found which histologically presents an undeveloped kidney. I would have some doubt of the diagnosis of renal hypoplasia in a case in which normal glomeruli are found because when they are formed a complete union must have been established.

Now the lack of the normal developmental union of the nephroblastema and ureteral bud allows us to explain the aplasia and hypoplasia; but we have no explanation as to why this union does not occur. Certain cases of aplasia are interesting in that they form a distinct group among the greater number of aplasias: in these cases the more or less developed ureter opens into the vas deferens or into the seminal vesicle. I have a picture taken from a case observed and published in Marchand's laboratory: the ureter opens into the seminal vesicle; the kidney is absent. Another picture shows a case I observed when I was assistant in Sternberg's laboratory and which was described by Engel. It is of interest because on the strength of this case Engel attempted to give an explanation as to the reason of lack for union. One sees in the region of the right trigonum a cystic vesicle which collapsed when the bladder was opened. The sac when reconstructed was the size of a cherry and was filled with a peculiar slimy material. The ureter opens into the vas deferens on its medial side. There is no seminal vesicle in this case. The ureteral bud originates on the medial side of the primary excretory duct, and during further development the ureter wanders to the lateral side. Now Engel thought that the ureter remained on the medial side in this case and, therefore, growing upwards could not reach the site of the nephroblastema; therefore, no definite kidney was formed.

Another attempt at explanation was later made by Zimmerman, for the cases in which the ureter opens into the seminal vesicle. The seminal vesicle develops much later in embryonal life than the ureter bud appears. In fact, it is formed at the period at which the lower portion of the primary excretory duct has already become separated from the ureteral ostium into the bladder. In cases of union between ureter and seminal vesicle Zimmerman believes that the ureter originated from the primary excretory duct at an abnormally high level. It is plausible that in such an event the ureter will reach a higher segment than under normal conditions. We know, however, that the mesoblastic tissue of the thirty-first segment mainly has the potency of developing renal tissue and the thirtieth and twenty-ninth segments are of less or no capacity. Therefore, it is plausible that a union of the ureter bud with mesoderm of a higher segment will not develop a normal kidney. The nearer to the thirty-first segment the union occurs, the more renal tissue will be formed. That may account for the various degrees of hypoplasia encountered in various observations. Lately, the theory has been advanced that there might be an embryonal hypoplasia of the nephroblastema to account for certain cases of renal aplasia or hypoplasia. The older hypothesis of fetal nephritis or absence of the renal artery as cause of these anomalies does not hold any more.

I think particular interest attaches to those cases of hypoplasia where the kidney is normal in shape and development but small. They constitute actual dangers because, as Dr. Aschner has told me, a kidney might give a normal functional test but be unable to compensate for the other kidney if it is removed.

These cases of aplasia and hypoplasia of the kidney have stimulated embryology.

Dr. A. Hyman: We are fortunate in having presented to us this most interesting and important contribution. In the whole realm of kidney surgery there is nothing more disappointing to the surgeon than to operate on a diseased kidney and lose the patient, and then discover that it was due to an aplastic condition of the opposite kidney. As has been pointed out already, there are many different forms and degrees of aplasia, from the solitary kidney to the hypoplastic kidney that functions. In the last few years we have come across eight cases of solitary kidney. In none of these cases however, was the other side explored, so we cannot be certain that there were not in some cases small buds or small bodies of kidney tissue. It is not easy to decide if a patient has a solitary kidney. In 6 of these 8 cases of solitary kidney, there were definite pathological lesions. Solitary kidneys are very prone to disease. The point comes up of hypoplastic kidneys that function. The type of hypoplastic kidney that functions fairly well, as determined by indigo carmine, is difficult to diagnose. How do we determine whether or not such a hypoplastic kidney exists?

There are three examinations that may be of value. One is the difference between the roentgenographic kidney shadows of the two sides. If the diseased side shows a normal-sized outline, and the other side a very much smaller shadow, we should suspect a hypoplastic kidney. Another test is the pyelogram. These kidneys have very small pelves and very small calyces. The next test is the phenolsulphonphthalein output. I have investigated some of these cases and have found that there has been

a considerable quantitative diminution of phenolsulphonphthalein, although the time appearance may be normal. Last year I lost a patient because it was not recognized at the time that he had a hypoplastic kidney. He had had a calculus removed from the right kidney a number of years before. He returned to the hospital last year with a very large right kidney full of stones. The opposite kidney shadow was smaller than normal, but the function of this kidney was apparently normal. The kidney with the stone showed no function with indigo carmine. My intention was to do a nephrectomy, but the kidney was so markedly adherent that I thought it more advisable to remove all the stones and drain the organ. Following the operation the patient drained profusely from the kidney, 17 ounces the first day, 20 the second, and 30 ounces the third day. The left kidney never functioned after the operation. The patient was cystoscoped and catheterized, but not a drop of urine was obtained from the kidney. He became uremic, and on the fifth day, despite the fact that the right kidney was draining, he died. Autopsy showed a hypoplastic kidney on the left side.

Dr. H. S. Jeck: Several of the preceding papers have emphasized the fact that we should be as certain as possible that we are not dealing with a hypoplastic kidney on one side when our attention is focused on the obviously diseased kidney on the opposite side. That is, we should be sure that the function of the supposedly normal kidney is sufficiently good to maintain life. At Bellevue Hospital, during the past few years, we happen to have recognized in two instances such atrophic kidneys by means of Geraghty's formula. In an article[1] Geraghty sets forth that in an atrophic kidney the percentage of urea is likely to be normal, and the appearance time of phenolsulphonphthalein is often unchanged, but the total amount of phenolsulphonthalein and the total amount of urine excreted will be diminished.

To those of us who are not in the habit of making simultaneous bilateral pyelograms, this formula should be of value, as of course the making of a pyelogram is the only reasonably certain method of detecting the atrophic kidney.

Dr. Clarence G. Bandler: I would like to take this opportunity to present a specimen which is somewhat in line with the presentation of Drs. MacKenzie and Hawthorne, but not an aplastic kidney. Before doing so, I wish to recount a case that I saw three or four years ago. I was called in consultation to see a patient who ten days previously had been nephrectomized for tuberculosis. Since operation she had passed no urine whatsoever and it was definitely established that she was anuric. She died soon and post-mortem examination revealed only a renal bud at the site of the supposedly remaining kidney. From this bud there extended downward for about three inches a fibrous cord which continued as a definitely formed ureter into the bladder. I had been informed that it had been impossible to cystoscope this patient prior to operation and that the diagnosis had been made from clinical symptoms, urinary findings and roentgenography.

The specimen I show is that of an anaplastic kidney. Eight days ago I removed this kidney from a child ten years of age, and I would say that it is the smallest kidney that I have ever encountered surgically. It is fairly well formed, is full of stones, and shows a chronic pyelonephritis. The patient had had symptoms for eight years and on two occasions, six years ago, had passed small calculi. My first impression from the size of the kidney was that it was embryonic, but the pathologic report reveals that it is fully formed, but shrunken, with thick-walled and dilated calyces and pelvis. Microscopic section shows a markedly sclerosed kidney in which destructive changes are of highest grade in the medulla, although very little recognizable cortical tissue is found. The pelvis mucosa is almost completely denuded of epithelium and is infiltrated with lymphoid cells. The kidney was functionless and the roentgen-ray pictures showed a large calculous accumulation with very little surrounding renal tissue.

Dr. Paul W. Aschner: Dr. Hawthorne pointed out that in two of his cases there was a question as to whether he was dealing with a congenital aplasia or a secondary atrophy due to an obstructive lesion in the nature of a stenosis. Three or four years ago I presented before this Section a case of interest in this connection,—that of a young girl with an obstruction in the upper ureter which could not be passed at first but subsequently was passed. On pyelography the pelvis was found small and it showed only two calyces. The upper ureter for a distance of about 3 cm. presented a very thin

[1] Geraghty, J. T., and Plaggemeyer, H. W. The practical importance of infantile kidney in renal diagnosis. *J. Am. M. Ass.*, 1913, xli, 2224.

thread of fluid and then appeared normal down to the bladder. It was thought we were possibly dealing with an extrarenal tumor and exploration was done. At operation we found a very thin thread-like ureter, for about 2 inches below the kidney. I believe this was an aplastic condition of the upper ureter.

Dr. J. S. Read: It is a valuable clinical point to be told that the removal of these small masses of aplastic renal tissue is sometimes followed by complete clinical cure of the pain and systemic infection. Heretofore when no definite kidney mass has been found, we have refrained from doing anything. Now, thanks to this splendid piece of work, I shall know enough to remove the small pieces of indefinite tissue in the hope of producing a cure.

Dr. D. W. MacKenzie (closing): I wish to thank our confrères for their reception of this paper, the topic of which came to us when looking over the different types of cases on the service in the last ten years.

There are many cases of kidney aplasia in the literature but the clinical aspect has received very little attention. We felt the reported cases in this paper to be of some interest clinically, especially the symptomatology.

A few years ago before this Section we showed interesting anomalies of the kidneys, one with a double ureter on one side and also a small perfectly formed aplastic kidney on the other. Since then we have had another case, that of a child of three weeks, that had been killed by a fall from a fire escape. One kidney was normal, the other had an occluded strictured ureter with hypoplasia of kidney.

The secreting hypoplastic kidney is, I think, of even more importance to us in our diagnostic work. The main lesson is the necessity of examining both kidneys, especially if contemplating radical surgery on one.

PRESENTATION *of* INSTRUMENTS

A NEW SUPRAPUBIC SUCTION TUBE

J. SYDNEY RITTER, M.D.

Through the courtesy of Dr. Joseph F. McCarthy and under his supervision, I have been priviledged for the past year and a half, at the New York Post-Graduate Hospital, to study suprapubic suction drainage.

At the American Urological Association meeting in Boston, Dr. McCarthy and I presented the various apparatus in use at the New York Post-Graduate Hospital. Since then we have had difficulty in continuing suction up to the closure of the bladder; and for this reason the suction tube which I am presenting has been devised.

We have used the suction tube devised by Dr. Gile, but have found, first, that in thin individuals in whom the abdominal wall was thinner than the length of the tube, the tube would prevent closure of the bladder; second, it was difficult to clean this tube due to the fact that it is curved; and third no provision was made for an air inlet above the supporting plate. These three disadvantages we have tried to overcome by the tube I describe.

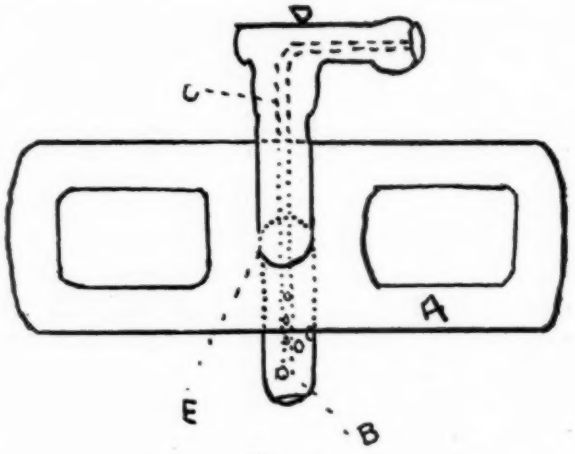

Fig. 1.

I should like to mention that Dr. H. B. Devine of Australia has described a tube similar to the one presented, differing in that no air inlet was provided above the plate (Fig. 1). The tube is composed of four separate parts: first a flat, oblong plate, with a central lumen, having a small cannula (E) for receiving the tube (B). Two lateral sections have been removed from the plate to diminish the weight and also to furnish a means of tying a tape so as to keep the apparatus in position.

The tube (B) is a simple metal tube which fits snugly into the cannula (E) provided for it in plate (A) and can be kept at the desired depth. There are several perforations arranged in a spiral at the lower third of the tube. At the upper extremity is a thread for screwing the tube into the cap (D). Just below the thread are two perforations permitting inlet of air, avoiding trauma to the bladder mucosa and surrounding tissues by the suction.

The inner tube (C) has a narrower lumen than tube (B) but essentially is the same. There are no openings below its thread, for it is the suction tube and suction is desired at the lower end. Its

lumen is a direct continuation of the lateral canal in the cap to which suction is applied.

The cup has a lateral tube whose lumen is a direct continuation of the lumen of the smaller perforated tube. The cap has two threads, one for the outer, protecting tube and a second for the inner, perforated suction tube.

Due to the facts that the depth of the tube is adjustable, that a vacuum in the bladder is avoided and that the tube can be very easily taken apart for cleaning, it has eliminated our former difficulties.

A NEW TYPE OF FLUOROSCOPIC SCREEN FOR USE IN KIDNEY OPERATIONS

I. SETH HIRSCH, M.D.

The recording media at present utilized in examinations with roentgen rays are the sensitive silver emulsion and the fluorescent screen. The former gives a permanent, indelible image, and the latter a transient and evanescent one which disappears when the energization of the tube ceases. It seemed desirable for many reasons to possess a means by which the fluorescent image might be retained for prolonged intervals after the energization of the tube. Such a device could be applied, and utilized in many ways as an aid in the various radiological diagnostic procedures.

To this end, I devised a fluorescent screen which retains the image for a prolonged period, and discovered a method of reviving the image, when it has almost completely faded from view.

The screen consists of a fluorescent emulsion which may be spread, as usual, on paper, or on any other surface permeable to the radiation, such as aluminum, silver, etc. If the screen hitherto in use is such as gives the maximum fluorescence with the minimum amount of after-fluorescence, the screen I have devised may be considered as giving a maximum fluorescence and the maximum after-fluorescence, thus permitting reference to the image at any time, and a transference of this image away from the point of energization of the tube. Besides this, the fluorescence of the emulsion may be intensified by the application of heat and thus an image which, with time, has almost faded may be revived.

For the kidney examination at the operating table this method readily replaces either the fluoroscopic or radiographic methods now utilized. When the kidney has been partially delivered and it becomes important to know the position, number and size of calculi, the fluoroscopic examination with the usual screen necessitates exposure during the entire examination. Under the best circumstances this examination at the operating table is difficult and, for obvious reasons, dangerous. The film examination of the partially delivered kidney is objectionable in that the development of the film takes an appreciable time before it may be viewed. The examination is, however, much simplified by the use of this screen.

For this purpose, a small hand fluoroscope has been devised, with a removable front which consists of a small metal photographic film holder, containing the screen.

This screen is sensitive to heat, light, ultraviolet light, roentgen rays and radium. Hence, it must be kept within its holder, and the slide must not be pulled out except when the holder is in the hood.

This being a method of fluoroscopy, sensitization of the eyes by darkness or dark glasses is necessary.

It is first necessary partially to sensitize the screen. The plate holder is removed from the hood and placed with the aluminum slide toward the roentgen-ray tube. The roentgen-ray tube is then energized for 2 seconds at a distance from the screen of 10 inches with 10 milliamperes of current. The cassett is then placed in a sterilized rubber envelope. The envelope is placed under the delivered kidney.

The roentgen-ray tube is placed at a distance of 8 to 10 inches from the kidney. With 10 milliamperes and 40,000 to 50,000 volts, an exposure of 10 seconds is made. The cassett is now removed from the envelope and slipped into the hood. The eyes are placed against the opening in the hood. The slide of the hood is withdrawn and the fluorescent image is viewed. The image will persist for 10 minutes under ordinary circumstances, gradually growing fainter. At the end of 10 minutes the screen may be used again. If it is desired to make an exposure of the screen immediately after the first exposure, the first image can be obliterated by exposure to the roentgen ray for 2 seconds or by exposure to the light of an electric bulb for the same time. The screen is then ready for another image.

I do not claim perfection for the method as yet. I am sure, however, that it has possibilities. By changing its salt content the screen may be made more or less fluorescent, and the

image may be made more or less persistent. It has to be suited to the particular needs, and this can be done.

Discussion

Dr. A. Hyman: The apparatus shown by Dr. Hirsch opens up great possibilities connected with the fluoroscopy of calculi on the table. There is no question about the advisability of employing roentgen-ray plates or fluoroscopy for cases of multiple calculi on the operating table. At Mount Sinai Hospital we are doing it now as a routine procedure. At first we tried fluoroscopy, but found many disadvantages in that method. It is often impossible to bring the kidney out on the abdominal wall so that we finally discarded that method and have been using the plate method, developing the plates immediately in a special dark room on the operating floor. The disadvantage is the time lost in waiting for the development of the plate, this is usually 7 to 10 minutes.

As to the advisability of making such examinations, I have in mind three cases in which the operator was firmly convinced that all of the stones had been removed; in all of them the roentgen-ray plates taken on the table showed fragments that had been overlooked and later might have been considered recurrences.

The method which Dr. Hirsch has shown is, of course, a great improvement on the ordinary fluoroscopic screen; if it works out as well with stones as with the keys and other bodies shown heretofore, it will be of great assistance. Of course, we shall have to experiment with the different types of stones: uric acid, phosphatic, etc., in order to differentiate the intensity of the shadow; but judging from the demonstration it seems to be a very valuable procedure.

Dr. L. T. LeWald: There are two reasons for using a film, which I would like to mention. One is that the film is much more delicate in recording shadows than the fluoroscopic screen, and I prefer it, especially in cases of very small calculi, rather than the screen images. I have just read a book by Sir John Collie,[1] the English medical jurisprudence authority, who calls attention to the fact that, for example, fractures of the bones have at times been missed in attempts to diagnose them by fluoroscopic methods, and that later on these fractures were shown on the roentgenographic film. The same thing applies here. The most minute fragment is the one we want to be sure is not left behind, if it is possible to remove it. The second reason is that in the film we actually have a record which may be used to prove that everything possible was done to show that no fragment was left in the kidney. That record can be filed and used later on if necessary. The fluoroscopic record would be a matter of personal opinion, and we would have nothing to show for it.

[1] Collie, Sir J. Malingering and Feigned Sickness. London, 1917, p. 471.

Dr. E. L. Keyes: Dr. LeWald's remarks remind me of a case I saw operated upon with the aid of films at a very scientific clinic. Stones were removed from the kidney, a pyelogram was made, developed, reported back as showing more stone, the operator fished more stone out, took another film, sewed up the wound while waiting to hear the report and that report was still "more stones."

The element of time, therefore, is of great importance and I look forward to receiving much assistance from Dr. Hirsch's films.

Dr. F. T. Lau: It would seem that Dr. Hirsch has given us something very practical, and if we can with it realize the difference in shadows of stones of different compositions we will have a very valuable addition to our armamentarium for eliminating kidney stones.

Dr. I. Seth Hirsch: Dr. Keyes has answered Dr. LeWald's argument. When it becomes necessary to repeat the examination several times, this screen examination is certainly superior to the film examination, for it takes 10 minutes to get a film exposed and developed.

To make sure that small shadows are not overlooked a magnifying glass may be incorporated into the hood.

I know that a film shows more detail than does the fluoroscopic screen image, but Dr. LeWald ought to know this is not because the screen is less sensitive to roentgen ray. On the contrary, any fluoroscopic screen is far more sensitive than any photographic emulsion. But ten times as many roentgen rays are used in making the film as in fluoroscoping. If the same amount of energy is used in fluoroscoping as in making the roentgenogram the most exquisite detail of deep and superficial parts may be seen in the screen.

I do not present this as a perfected instrument. Only by trial can it be made so, but it has possibilities of being of great use to the genitourinary surgeon.

THE McCARTHY PUNCH

C. TRAVERS STEPITA, M.D.

This new instrument of Dr. Joseph F. McCarthy is a prostatic punch or median bar excisor that permits these manipulations under the guidance of the eye, and renders the operative field easily visible at all times.

The McCarthy punch consists of a large caliber beaked sheath with an obturator, used for introduction and removal of the sheath, which when introduced, obliterates the fenestra in which the median bar or prostatic lobe is engaged. The blade, or sharp circular tube plunger is worked with a pistol grip handle. This tube is detachable from the sheath by a bayonet joint, and the handle and cutting blade are easily removable. The McCarthy visual system is utilized, and it is to be noted that the light and lens do not move along with the cutting blade, but remain stationary. An irrigating attachment, which keeps the visual field clear with a continuous flow, is provided with the cutting part.

After biting out an intrusion, the blade and pistol grip are removed, the sheath remaining in situ, and the telescope together with an electrode and continuous irrigation system are introduced. In the clear field, the bleeding can be located and diathermized.

This cold punch with its accurate application under the guidance of the eye will remove large pieces of tissue leaving a clean incised area which heals quickly without the annoyance of delayed bleeding or the higher incidence of febrile reactions which one may find when the cautery blade is employed.

(*No discussion*)

PRESENTATION OF SPECIMENS

BILATERAL HYDRONEPHROSIS WITH HYDROURETER CAUSED BY PHIMOSIS

C. TRAVERS STEPITA, M.D.

S. G., aged one month, admitted to the Post-Graduate Hospital as a feeding case, April 1, 1926.

Family history: Irrelevant.

Past history: Birth at 9 months. Labor normal. Except for constipation, the past history was negative. Fed entirely from mother's milk, every two to three hours. Appetite poor.

Present illness: The baby had been sick since birth. Never took feedings well. Had been constipated, so mother had been giving one dram of castor oil daily. Had an umbilical hernia.

The chief complaints were vomiting, failure to gain in weight, and constipation since birth. No urinary disturbances noted.

Physical examination: General appearance that of a thin, premature baby of four pounds, cold, sick and rather cyanotic. Respiration normal. With the exception of some abdominal distention, physical examination negative.

Temporary improvement in condition under medical care, but condition gradually worse as severe cough developed. Died April 8, 1926.

Post-mortem findings: Body is that of a poorly nourished and emaciated male infant of one month. Abdomen considerably distended. Scrotum edematous and giving the appearance of a double hydrocele.

Both kidneys show marked fetal lobulation and are mottled purplish-red, especially in their lower portions. The right renal vein appears to be blocked with clotted blood. On section, both kidneys show a marked hydronephrosis, pelvis of each kidney being widely dilated with considerable thinning of the kidney substance, more marked in the left than in the right, the former being 4 to 7 mm. in thickness and the latter 8 to 10 mm. Both ureters are widely distended, with thinning of their walls, and very tortuous in their course.

The bladder is moderately distended to the size of an English walnut. The walls somewhat thickened, but the rugae are not marked. There is very marked phimosis, so that the praeputium cannot be retracted. The testes are very small and undescended, each lying in the abdominal ring. Each shows a slight hydrocele. Each scrotal sac is distended with fluid to about the size of a pigeon's egg.

Microscopic: the kidney pelvis shows some fibrous thickening of the subepithelial tissue. The deeper portion of the stroma is edematous and thickly infiltrated with extravasated red cells. In the medulla the tubules are generally well preserved. Some of them are quite widely dilated. The intertubular vessels are deeply congested. In the cortex the convoluted tubules are distended and contain inspissated albumin, and rarely a hyaline cast. In many tubules the epithelium is well preserved, but in some of the cells appears ragged, and shows some disintegrated nuclei. The glomerular tufts are deeply congested and in some of the glomeruli the

capsule contains coagulated serous exudate. The intertubular vessels are much congested and the capsule shows edema and infiltration with extravasated red cells.

Summary: Bronchopneumonia of both lungs. Hydronephrosis of both kidneys, with marked distention and distortion of both ureters. Hydrocele of scrotum and both spermatic cords.

Discussion

Dr. A. Hyman: This is the first case of this type that I have seen, although in the German literature there have been numerous reports of this condition. I would like to know, however, if Dr. Stepita is certain that there was no contracture of the internal urethral sphincter. Post-mortem, one can overlook a contracture of the neck unless the specimen is arranged in a certain way.

Dr. C. T. Stepita: Replying to Dr. Hyman, we found that the condition of hydronephrosis and hydroureter was due to the phimosis. Dr. Klemperer examined the specimen and came to that conclusion also.

FIBROSIS OF THE RENAL PELVIS WITH HYDRONEPHROSIS

C. TRAVERS STEPITA, M.D.

G. F., male, aged twenty-three, clerk, Hebrew, was admitted to the Post-Graduate Hospital, December 15, 1926, complaining of dull pain in the right lumbar region, radiating to the right lower quadrant, and of fifteen months duration. Has had similar attacks for the past year, at intervals of two or three weeks. The attacks lasted approximately 12 to 18 hours, and were relieved by heat. No urinary difficulty after or during the attacks. No hematuria; no rigidity or tenderness of abdomen or lumbar region. The urine is macroscopically clear. Roentgenogram of the genitourinary tract shows no evidence of calculi. Cystoscopy shows a normal bladder and ureters; the posterior urethra engorged, irregular; otherwise negative.

Ureteropyelogram of the right kidney, with 20 c.c. of 12 per cent solution of sodium iodide, injected by gravity: Examination shows marked pelvic dilatation, with a cystic-like appearance of the major calyces and further complete blunting and obliteration of the minor.

On December 17, two days after the patient's admission he was cystoscoped, both ureters were catheterized, and sterile specimens were obtained for examination and culture. The urine from the left kidney was clear and the flow was normal. The urine from the right kidney was turbid, the flow constant, filling two test-tubes. Five c.c. of indigo carmine were injected intravenously. Appearance time: left kidney, 5 minutes, with a 4 plus concentration; right kidney, 32 minutes, with a quantitative estimation of ½ plus concentration. Cultures of both right and left kidney urines were found negative.

On December 21, 1926, the right kidney was removed by Dr. Joseph F. McCarthy, with the diagnosis of chronic, right hydronephrosis of kidney, and anomalous contracture at the ureteropelvic junction. The convalescence was uneventful, and the patient was discharged cured, January 5, 1927.

Pathological report: The specimen consists of the right kidney, which measures 12 cm. in length by 7 cm. in width, by 4.5 cm. in thickness. The capsule is thin and strips easily from the smooth renal surface.

The most conspicuous feature about the specimen is the moderately dilated plevis which at the hilus of the kidney measures 2.5 cm. in diameter. This dilated pelvis tapers sharply to the beginning of the ureter, which is ligated as it bends sharply in a horizontal direction, but shows no gross thickening and readily admits a probe. Above the severance of the ureter 1.5 cm., the wall of the dilating pelvis becomes greatly thickened and stiff. The mucosa is finely granular and mottled with punctate elevated hemorrhages. Similar hemorrhagic spots are found less abundantly in the pelvis proper, as seen on longitudinal section. Aside from dilatation, the pelvis shows nothing of importance. The kidney structure shows nothing of note.

Microscopic report: There is marked fibrous increase in the mucosa and submucosa of the lower portion of the pelvis. This even involves the muscle layer and extends downward into the beginning of the ureter. Small scattered areas of extravasated blood show beneath the pelvic epithelium, but the sections are remarkable for the absence of cellular exudate. Section from the kidney tissue shows nothing of note, the histological picture being essentially normal.

Diagnosis: Fibrosis of renal pelvis and ureter. Hydronephrosis.

Dr. Paul W. Aschner: This case presents a few interesting points. We are probably dealing here with the end-result of some previous

infection. The fact that there was no stricture in the ureter or ureteropelvic junction may not negative stasis in the kidney. The musculature of the pelvis or ureter may become so infiltrated that the proper physiological peristaltic action of the pelvis and ureter may be put out of commission. This is a possibility to bear in mind to explain some instances of the dilatation and improper emptying in which we find no stenosis in the course of the ureter. Destruction of the musculature by fibrosis may be the important factor in such circumstances.

Meeting of April 20, 1927

URETERAL STRICTURE: ITS ANATOMICAL AND PATHOLOGICAL BACKGROUND

MARTIN SCHREIBER, M.D.

(*Author's abstract*)

This study based upon findings in 100 unselected consecutive autopsies was undertaken to test, by both anatomical and pathological data, the conception lying behind that clinical entity which has been given the name of ureteral stricture. The evidence forming the basis for this concept has been, up to the present, for the most part indirect, that is, pyelographic and cystoscopic.

The following questions were to be answered:

1. Does there exist such a pathological entity as predicted by Hunner and his followers?

2. If it does, is it incidence as great as these reports would lead us to believe?

3. If it exists, what rôle, if any, does focal infection play in its etiology?

4. If focal infection is found to be not a factor, what is then the true pathogenesis?

5. What are the finer and yet gross "physiological," anatomical and structural forms that may give to pyelographic and wax-bulb methods those clinical signs which are interpreted as those of ureteral stricture?

The observations and conclusions in this report are based upon four types of material: 1. gross anatomical and pathological dissections; 2. histological preparations; 3. autopsy records; 4. clinical records.

For histological material the entire pelvic ureter from the iliac zone of narrowing down to and including the pars muralis was usually taken with a more or less thick mass of subureteral tissue giving in continuity various zones of the ureter for observation and comparison.

In this series of 100 consecutive autopsies there were found 26 cases with some type of ureteral disease. Of the 79 adult autopsies, there were 25 cases, or 31 per cent, presenting some type of ureteral disease, a surprisingly large figure, emphasizing the relative importance of this structure in the general economy.

There was found an autopsy incidence of 13 per cent hydroureteronephrosis secondary to obstruction. Of these 13 cases, 12 were due to ureteral obstruction. The site of obstruction was a narrowing or stensois in 10, and a dilatation coincident with or secondary to a postinflammatory scarring of the ureteral wall in 2 cases.

Of the 10 cases of stenosis, 5 or 50 per cent (or 5 per cent of the entire series) were of congenital origin. Of the remaining 5 cases, 2 were either caused by or were coincident with localized subureteral scarring in the region of the ligamentum latum, 2 were due to kinking of the ureter over anatomical structures (in one over the uterine artery, in the other over the vas deferens), and the remaining single case was the only one caused by a chronic fibrotic inflammatory process compromising the ureteral wall in such a way as to partially occlude its lumen. However, this localized fibrotic ureteritis (in the juxtavesical region) was definitely secondary to an active and intense acute and chronic cystitis. There was not a single case in which the lesion required the hypothesis of blood-borne focal infection for its complete explanation.

The author demonstrated 15 lantern slides showing the gross anatomical and histological findings in the above 12 cases;

the pertinent premortem clinical findings were included in the presentation of each case.

He also presented a series of lantern slides showing the possible anatomical sources of error in diagnosis, especially in the use of the wax-bulb "hang" method. The juxtavesical zone of narrowing deserves major emphasis, this region being not only a relatively constant site of ureteral narrowing, but also a constant site of increased gross density of the ureteral wall. Histologically, this density is seen to be due to an increase in thickness and density of the fibromuscular tunica, as compared with all regions above this zone.

The other physiological zones of narrowing to be emphasized are the pars arterialis, the pars vas deferens, occasional narrowing overlying the obliterated hypogastric artery, and redundant folds of mucous membrane, so-called valve formation.

CONCLUSIONS

1. Ureter stricture *does* exist as a definite pathological entity.

2. A 12 per cent post-mortem incidence of ureter stricture or stenosis corroborates the great number of ureter strictures or stenoses reported clinically.

3. Latent symptomless hydroureteronephroses due to ureter stricture or stenosis are of relatively frequent occurrence, as is evidenced by a post-mortem incidence of 10 per cent in this series.

4. Ureter stricture as a localized intrinsic inflammatory process in the ureteral wall, metastatic from a focal infection, apparently either does not occur, or is an extreme rarity as compared with ureteral strictures or stenoses of other origin.

5. Ureteral stricture or stenosis is most frequently found in the pelvic ureter in a zone about 2 to 6 cm. from the ureteral orifice.

6. As prime etiological factors in the pathogenesis of ureteral obstruction due to stricture and stenosis I would emphasize in the order named:

a. Congenitally accentuated narrowing of a congenitally physiologically narrow site.

b. Extension of inflammatory processes into the ureteral wall from (1) Adnexal disease, with and without thrombophlebitis; (2) advanced chronic cystitis.

c. The occluding kinking power of crossing anatomical structures—the vas deferens in the male, the uterine artery in the female.

7. The interpretation of the physical signs obtained by the wax-bulb hang method of Hunner, especially in that very important region 2 cm. to 6 cm. from the ureteral orifice, must always be conditioned by the physiological sites of narrowing and increased density of the ureter wall found in this region, namely:

a. The juxtavesical zone.

b. The iliac zone.

c. The ligamentum latum region—crossing of the uterine artery.

d. The vas deferens region—crossing of the vas deferens.

e. The site of the obliterated hypogastric artery.

f. So-called "valve formation" in the juxtavesical region.

THE RÔLE OF THE URETER IN DISEASES OF THE GENITO-URINARY TRACT

THOMAS J. KIRWIN, M.D.

This paper, presented with numerous lantern slides, will appear in a later issue of the JOURNAL.

Discussion

DR. GUY L. HUNNER: After two such papers as these, one is at a loss where to begin the discussion. When one has a large proposition to put over, he instinctively turns to the metropolis. This is true in matters of big business and is often true in philanthropic enterprises. So the urologists of the country, when they feel they have discovered something worth while, like to come before this society and have it passed upon.

It is needless to say that it has been a peculiar privilege and pleasure to me to listen to Dr. Schreiber's presentation of this unusual piece of work; and it is unusually interesting to me

to have had Dr. Beer the man who sponsored Dr. Schreiber in this work. Dr. Beer has been one of the honest but very obstinate skeptics concerning the ureteral stricture concept; and to have him back a man who goes to Europe to demonstrate by autopsy findings that ureteral stricture cannot possibly have such incidence as has been claimed, and who returns with the report that he found it in 12 per cent of autopsies, is almost too convincing. It is well worth the trip to New York to learn what is Dr. Beer's reaction on this piece of work.

Dr. Schreiber undoubtedly showed cases of congenital thickening of the anatomical points of narrowing, and to have 5 cases of 12 put in that class, having no inflammatory reaction at all, certainly convinces me that I have been placing rather too much emphasis on the question of focal infections in speaking of the etiology of stricture. I have been well aware that in certain patients I could not find any focus of infection to account for the stricture, and this work shows that I have probably been emphasizing that factor too much. On the other hand, while Dr. Schreiber comes to the conclusion that his autopsy work shows no reason for ascribing focal infections as the cause of stricture, I am sure that he will soon find that his clinical work varies from his autopsy work, for he will be unsuccessful in many of his clinical cases if he attempts to give them adequate permanent dilatation without taking into account distant foci of infection. In many patients presenting ureteral stricture and a manifest distant focus of infection I have deliberately ignored the possible relationships between the two, until I have given what should be adequate ureteral dilatation, only to find that many patients had to be referred for attention to the focal infection before the stricture areas would remain permanently dilated.

It requires much patience to study and record our clinical activities properly if we wish to have results of scientific value. If we begin by several lines of attack at the same time and end with good results, we cannot estimate the relative value and effects of each therapeutic measure employed. It has, therefore, been my practice to try out patiently one line of treatment at a time.

As to the interpretation of the 7 cases Dr. Schreiber reports associated with mechanical and inflammatory conditions, only careful future work can finally show us the real significance of these various factors. Some of his cases were apparently associated with scars and inflammatory conditions in the subperitoneal tissues, and it is quite within the range of possibility that these represented past inflammations derived from distant foci of infection. Some of his specimens were manifestly associated with a gross pathologic process in the genitalia. As a gynecologist I have constantly been surprised at the few ureteral stricture lesions that seem to be secondary to gross disease of the internal genitalia. This is one of the reasons that has influenced me in concluding that most of the inflammatory strictures are secondary to a distant focus of infection. Be that as it may, there are papers now appearing frequently on the pathologic aspects of ureteral stricture; and in time we may hope to have many of these questions answered. Meanwhile, I think we are all agreed that Dr. Schreiber has done a fine piece of work, the most telling by far that has yet appeared in relation to ureteral stricture.

One stumbling block to those who have not investigated this question clinically has been the large number of cases reported by all those who have made systematic inquiry, and if stricture can be found in 12 per cent of autopsy cases everyone must admit that it is a disease of frequent incidence. Some of us are old enough to remember with what reluctance the profession as a whole admitted the frequency of gallstone disease. As soon as the pathologists told us that gallstones were found in 10 per cent or more of autopsies on adults, the diagnosticians were forced to give up the idea that this disease was merely a fad of the surgeons, and they then gave more attention to its clinical diagnosis.

Not only has Dr. Schreiber demonstrated that ureteral stricture is a common lesion, but he has answered one of the stock questions of those who have been content to argue instead of investigate, namely, "Why have not the pathologists found stricture if it occurs so frequently?" From the beginning of this work I have had to do a few retrograde dilatations of stricture, and in the course of pelvic and abdominal operations I have had opportunity to study ureters previously treated for stricture, and seeing and handling strictures *in vivo* has convinced me that the pathologist would find them as soon as he looked for them.

Another stock question has been, "If stricture is due to focal infection, why is it not found in the male?" My answer has been, "Why was

stricture not found in women until it was looked for by methods that would demonstrate the lesion if present?" Later Folsom, Goldstein, Livermore and others showed that stricture is prevalent in the male; and I consider this question as finally answered by Rathbun, who in his Brooklyn clinic in 1924 diagnosed 92 cases of stricture, 48 in men and 44 in women.

I think the most important question relating to ureteral stricture now before urologists for their solution is the correct interpretation of their roentgen-ray films. While I thoroughly enjoyed Dr. Kirwin's scholarly paper and his remarkable series of slides, yet I have to differ with him in the interpretation of many of them. He showed many slides demonstrating stricture in the lower ureter, and redundancies in the upper ureter, some of which he emphasized by taking the film with the patient in the erect posture. He seems to place far more emphasis on these prolapses of the upper ureter than I would. The distensible ureteral tube dilates in both the lateral and vertical axes, and its increase in length is bound to result in an irregular course of its usual relatively straight axis, particularly in its upper few centimeters which normally are most free from surrounding supports. This leads to what many urologists still speak of as kinks, and ascribe as the cause of the kidney affection. I look upon most of these angulations as "roentgen-ray kinks," and their innocuous character is demonstrated by ignoring them and relieving the patient's symptoms by dilating the stricture in the lower ureter.

Of course we do find some pathologic angles of insertion, especially in the larger hydronephroses: actual strictures of the upper few centimeters of ureter, periureteral bands causing actual obstruction by pressure or suspending action, secondary interference by anomalous vessels, and compressions by perirenal infiltrations; but these are relatively few as compared with the many simple redundancies of the dilated upper ureter, and careful urogram reading is a great help in our prognosis to the patient as to whether simple dilatations will relieve their symptoms or whether they are facing an operation.

Another problem which the urologists must study deals with the traditional view that any obstruction in the lower ureter, which leads to stasis and symptoms must register on the roentgen-ray film as a grossly dilated tract above. Logically this traditional view is correct, but, as occurs so often in medicine, logic and facts do not always coincide. I shall show a series of slides that have been diagnosed by our roentgen-ray department as normal. Inasmuch as that department has been trained by our urological department in this field of interpretation, it is not surprising that these films have been read as normal, but I submit that it is of decided moment to the patient whether the urologist and roentgenologist decide that he has a serious lesion of the urinary tract that can be relieved in a simple manner by the urologist, or whether he is submitted to a serious but useless abdominal exploratory operation, or perchance to several weeks or months of an expensive rest cure.

The use of the bulb is a simple and logical method of determining whether a patient has stricture, whether this is single or multiple, annular or diffuse; and with the data obtained by the bulb we are in a position to make a much more accurate interpretation of the roentgen-ray film. As a matter of experience the most painful strictures to treat, and the most obstinate in yielding to treatment, are those accompanied by so little dilatation above the stricture area that they have always been interpreted on the urogram as normal.

There is other evidence than that furnished by the bulb and the slightly altered urogram to convince the urologist that he is dealing with one of these hypersensitive types of ureteral stricture. After the investigation with a plain catheter a patient with this type of obstruction often has the so-called ureteral chill, and extreme kidney colic accompanied by nausea and vomiting, and an exaggeration of whatever symptoms the patient previously complained of. Temporary relief of the previous symptoms following this severe reaction is suggestive. Improvement in the general well-being during the dilatations, and final recovery, are all phenomena that, seen in a sufficient number of cases, convince the urologist that he must break from the traditional method of urogram reading and properly interpret certain slight variations which he has been taught to overlook.

Dr. N. P. Rathbun: No subject in urology has brought up so much discussion, amounting at times almost to rancor, as this question of ureteral stricture. I have always felt that where there was so much smoke there must be some fire, and when we see men group themselves on two opposite sides of a subject it is fair to say that neither group is entirely right or entirely wrong. The slides that Dr. Schreiber

exhibited are very interesting, particularly those that showed inflammation in and about the ureters; I have in mind one which extended into the ureter wall. I have always differed with Dr. Hunner on the subject of focal infection. I believe that this is not necessarily the most prominent cause; that stricture might well occur from inflammatory conditions in adjacent regions, etc. Then, too, I have always felt that some strictures are part of an ancient pyeloureteritis that left scars. None of the slides of Dr. Schreiber will show that; and yet if he had another hundred autopsies he might find some such condition.

Another question, entirely apart from Dr. Hunner's bulb and the pyelogram, is the clinical picture and the results of dilatation. I don't see how you can ignore the fact that if patients come with the story of pain, etc., and after dilatations say that they are better than for years, that is very convincing. The slides that Dr. Hunner has shown demonstrating increase in the phthalein output and increase in the functional capacity of the kidney are very convincing. I lay no claim to infallibility nor do I believe Dr. Hunner does. I assume that I have made a diagnosis of stricture of the ureter a number of times in which no such condition existed and I have no doubt that Dr. Hunner is quite willing to admit that he has done the same. I think it is equally possible that a number of men who have scoffed at the idea of such a condition have missed a number of strictures because they have not looked for them. For many years every patient that I have seen who complained of pain has received a complete and thorough investigation, including pyelography and ureterography. For many years I have seen no reactions that caused disturbance. I have done it many times and have not done the patients any harm, and many times I have picked up points that might otherwise have been missed.

Dr. Edwin Beer: This is such an harmonious love-feast that it would be very ungracious on my part, I fear, to interfere in any way with its general tenor. I am encouraged, however, to make a few remarks, in view of the fact that some of the speakers have indicated that they are not in perfect accord on all matters.

Dr. Hunner, in my opinion, has not entirely proved the frequency of strictures of the ureter, that they are due to focal infections, and that they can be diagnosed by the wax-bulb hang. As he admits logically, if there is a stricture of the ureter, the proximal part of the ureter should be dilated, but he states that he has seen strictures as diagnosed by the wax-bulb hang method without any such dilatation. Is not this evidence that he is reasoning somewhat in a circle? All the more so, as Dr. Schreiber's interesting pictures showed regularly the dilatation, or almost regularly, behind the parts which he considers abnormally narrow.

This discussion reminds me somewhat of the discussion we used to hear of large calibered urethral strictures. If a No. 6 to No. 8 French catheter passes readily up the ureter without encountering an obstruction or finding a retention, are we justified in concluding that such a ureter is strictured? Dr. Hunner would state that on withdrawing a large calibered waxed bougie, if one feels a hang in using his technique —despite the fact that there is no obstruction going in—one must conclude that there is a stricture. What causes the bulb to hang I don't believe has been proved, nor has it been proved where the bulb is caught in this hang. Most of the obstructions seem to be found close to the bladder wall, perhaps some of them intramurally, according to the data that Dr. Schreiber has shown us; and I, personally, have encountered such cases due to extraureteral disease in the parametrium, perivesiculitis, pelvic osteomyelitis, and the like, as well as in the more common types of stricture due to tuberculosis and ulceration following ureteral stones that have remained *in situ* for a long time.

It is hard to see how Dr. Hunner could have collected such a large number of cases as 2500—most of them with bilateral strictures—unless this is a very common condition. Stimulated by his writings and those of numerous others, my associates and I have been looking for it but have failed thus far to find any large number of ureteral strictures. One would expect by forcible dilatation of such ureteral strictures to get violent reactions with closure of the ureter, just as one gets them in strictures of the urethra, but apparently the whole stretching process is somewhat innocuous in most cases. There is no doubt that every once in a while the passage of an instrument up the ureter gives the patient a certain amount of relief, which I am inclined to attribute to the effect on the intramural ureter, or perhaps to the displacement of a small calculus, or the establishment of better drainage.

I am glad to say that I am in harmony with Dr. Hunner on the subject of ureteral kinks

which used to be considered the cause of all sorts of symptoms. Unless these kinks are fixed by a periureteritis, in my opinion they rarely produce symptoms.

This whole subject of ureteral disease is a most interesting one, and no one has done more than Dr. Hunner to focus our attention on these conditions. Still, I must conclude by saying that I am as yet not convinced that he has proved his point that strictures are very common, that they are bilateral usually, that they are due to focal infection, that they can be recognized regularly by the wax-bulb hang, and that the ureter behind the stricture does not have to be dilated.

Dr. O. S. Lowsley: Dr. Schreiber's paper is a valuable contribution to this general subject, and Dr. Kirwin's paper is the kind that one likes to have on hand for frequent reference. It contains many points of importance in the various discussions of ureteral lesions. One of the most amazing points in Dr. Schreiber's paper is that 35 per cent of adults in this consecutive study showed ureteral lesions. That is a piece of news to all of us, including Dr. Hunner. I don't believe he thought that nearly so large a number of lesions would occur in an autopsy series. The fact that 12 per cent of Germans had some stricture of the ureter certainly has removed that condition from being an American disease, as they tell us with a shrug of the shoulders.

Dr. Kirwin showed an important picture: the one which demonstrated beyond any question the appearance of a peristaltic wave. Some of these narrowings that we have shown as strictures have been called peristaltic waves. We have made a study of them, and they are always 2½ or 3 inches in length. As we make five roentgenograms we always pick up the peristaltic wave, and are able to recognize the difference between that and other conditions.

I quite agree that distortions have no significance, but I cannot agree that the real kink has no significance, especially where the kink appears only when the patient is erect. The reason that is not to be passed by lightly, as Dr. Hunner and Dr. Beer seem to think, is that recently we have been making studies of patients who have been operated on for appendicitis and not cured of their troubles. When a patient has a lesion of that sort and is cured by putting a belt on and by dilating with bougies and catheters, it has great significance to me. We have not 1 or 2, but 35 or 45 such cases; and the general surgeons have gotten into the habit of sending all patients to the urologist before instead of after operating on cases of chronic appendicitis. I feel that real kinks that cause obstruction, occurring with hydronephrosis cannot be passed by as inconsequent; they are of great consequence, and the patient is relieved by elevating the kidney.

Dr. R. L. Dourmashkin: I have a few lantern slides to show the relation of a stricture to formation of stone, and also to show what may be called a novel way of demonstrating a ureteral stricture by means of the rubber bag.

The evidence I have so far obtained would fail to support the claim of Dr. Hunner and his followers that strictures are found in practically all cases of stone in the ureter. It is true that in the earlier phases of the work I did not resort to ureterograms because I thought that the amount of information obtained was not commensurate with the amount of possible damage that may be done to the kidney by injecting an irritant solution in the presence of an obstruction below. But since the rubber bag was introduced it was possible to obtain some idea of what is going on in the ureter.

Even before the rubber bag was used, the strongest argument against the stricture theory in stone formation was the fact that the stone would recur after ample dilatation of the ureter. In some cases, the ureter was dilated up to 18 or 20 F. Certainly, these patients were free of stricture and yet they continued to manufacture the stones.

Dr. Schreiber (closing): I wish to point out several facts relative to Dr. Beer's remarks concerning the necessity of finding dilatation behind an obstructive lesion in the ureter. In several cases of prostate hypertrophy, the pathological data and slides of which were not presented here, there was found a definite narrowing with thickening of the ureter at the site of crossing of the vas deferens. (This type of obstruction has been well described from both the clinical and pathological sides by Tandler and Zuckerhandl.) In these cases, no dilatation of the ureter was found behind this narrowed zone, but instead there was seen a gross increase in the thickness and density of the entire pelvic and lumbar ureter. This gross increase in density was found to be due to a remarkable hypertrophy of the muscularis with an associated coincident deposit of dense intermuscular connective tissue. These cases apparently showed

a compensatory muscular and connective tissue hypertrophy in the ureteral wall behind a continued, or gradually increasing, partial obstruction.

It is my belief that this runs parallel with a general biological formula applicable to all smooth-muscled hollow viscera, namely, that the first result of a continued incomplete obstruction is a compensatory hypertrophy of the muscularis behind the obstruction. Dilatation occurs only as a result of decompensation, due either to too great a narrowing with too great a rise in intraureteral tension, or to destructive changes (inflammatory or circulatory) in the wall. Dilatation means decompensation with more or less urinary stasis. Lack of dilatation does not rule out an obstructive lesion, for an increased intraureteral tension due to an obstructive lesion may be compensated for by a resultant hypertrophy.

TRANSACTIONS OF THE SECTION OF
ORTHOPEDIC SURGERY
NEW YORK ACADEMY OF MEDICINE

Meeting of March 18, 1927

THE CHAIRMAN, DR. HARRY FINKELSTEIN, PRESIDING

THE STABILIZATION OF PARALYTIC FEET

WITH SPECIAL REFERENCE TO GRAVITY FLEXION: AS BASED UPON THE ANALYSIS OF 213 CASES

WILLIS C. CAMPBELL, M.D.

MEMPHIS, TENN.

IN any program for stabilization of paralytic feet, every factor must be duly regarded, or the end-results will not be satisfactory. Not only the foot itself must be considered, but also the relation of the foot to the leg, and the mechanics of impaired function in both lower extremities and the spine. However, the problem of stabilization will be discussed only as related to the facts elicited in 213 cases that have been carefully observed during the past five years, when associated with the author's operation for drop-foot. A preliminary report of this procedure was made in 1923 before the American Orthopaedic Association, and a second report was made before the Orthopedic Section of the American Medical Association, in 1925, after more definite conclusions had been reached. As approximately five years have now elapsed since the first operation, sufficient evidence has been acquired to determine the real value of this procedure. Also, material knowledge has been gained from postoperative observation of associated procedures, as arthrodeses of the tarsal joints. The correction of gravity flexion or drop-foot, and the operative technique thereof will be discussed first and, following this, the necessary accessory procedures on the forefoot and tarsals.

Gravity flexion, or drop-foot, is the inability to dorsiflex the ankle joint or foot, and is the result of any agent that impairs or abolishes the muscular power in the anterior group of leg muscles. The etiologic factors are: destructive changes in the muscles and tendons, toxic neuritis, as in lead poisoning, trauma to the external popliteal nerve, spastic paralysis and, most frequently, poliomyelitis, or infantile paralysis. Drop-foot may be simple, when only the anterior muscles of the leg are involved, or it may be associated with varus, valgus or flail-foot, if loss of muscle power is more extensive. As the anterior muscles of the leg are more frequently paralyzed than any other muscle group as a sequela of poliomyelitis, inability to dorsiflex the foot is very common.

All operative procedures, with the exception of the one under discussion, attempt to suspend the foot from the anterior aspect of the leg by silk cords, paralyzed tendons, transplanted fascia lata, etc., but the result of such methods is uncertain and often disappointing, as the constant force of gravity by the pendulous foot causes elongation of the improvised ligaments, with recurrence. It has become so universally recognized as to be an axiom that paralyzed tendons will not permit stress.

Prior to my first article, in 1923, there had been no claim to the prevention of

drop-foot by arthrodesing operations of the foot, nor has an operation on the mid-tarsus ever been effective in correcting gravity flexion. I tried repeatedly to deviate the foot upward at the junction of the body and neck of the astragalus after removing the neck and a corresponding portion of the calcaneus and cuboid, but it was found mechanically impossible to prevent drop-foot successfully in this manner.

In a small proportion of cases, it is possible to limit gravity flexion by backward displacement of the foot, but this is not a dependable procedure and requires too extensive dissection of the malleoli. Whitman's astragalectomy is an excellent procedure and a dependable measure for the correction of drop-foot in flail-feet or lateral deviations, but is seldom indicated in the type under consideration. Panarthrodesis of the astragalus limits plantar flexion by obliterating all motion, but the disadvantages of a stiff ankle are well known.

Fig. 1. A. Skin incision for bone-block operation.

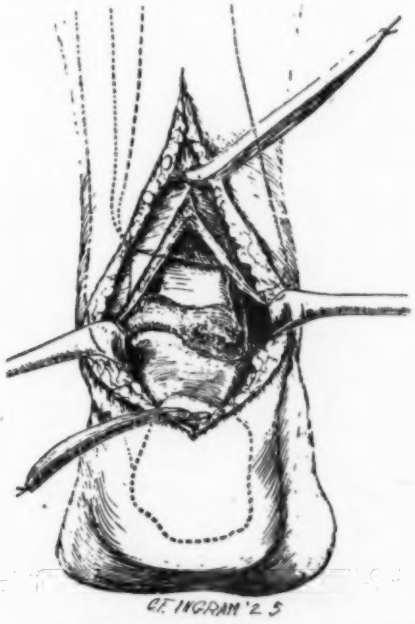

Fig. 2. Pyramidal space showing superior surface of os calcis and posterior aspect of ankle joint.

In 1919, the American Orthopaedic Association appointed a committee which made a most exhaustive investigation of the various operative methods for paralytic feet, and their end-results. This committee, after observing for two years the results in many large clinics of America, made a comprehensive report in 1921, to which reference may be made. They concluded that reconstruction operation on the skeletal system proper was essential in a large percentage of paralytic feet, such as astragalectomy and arthrodesing operations of the tarsus with backward displacement of the foot, following the principles promulgated by the late Gwilym G. Davis, of Philadelphia. At this time, the views expressed by this committee were apparently the crystallization of opinion of the surgeons present, which had been evolved by years of experience. This committee, very clearly states regarding gravity flexion, or drop-foot: "None of the operative measures considered can be confidently recommended as a standard procedure."

In 1922, the first operation for the correction of drop-foot by the bone-block method was performed upon a child, aged nine years, with excellent results to the present time. Since then, this procedure has been carried out routinely when necessary, in conjunction with other measures

for stabilization of feet, and occasionally independent of other measures. The entire object of this operation is to construct a stop-joint, by transplanting or building up a mass of bone on the superior surface of the os calcis, thus forming a permanent bony process limiting plantar flexion by impingement on the posterior surface of the tibia. The technique is as follows:

The skin incision is made over the tendo Achillis, if this structure is contracted; otherwise, to the outer or inner side, as

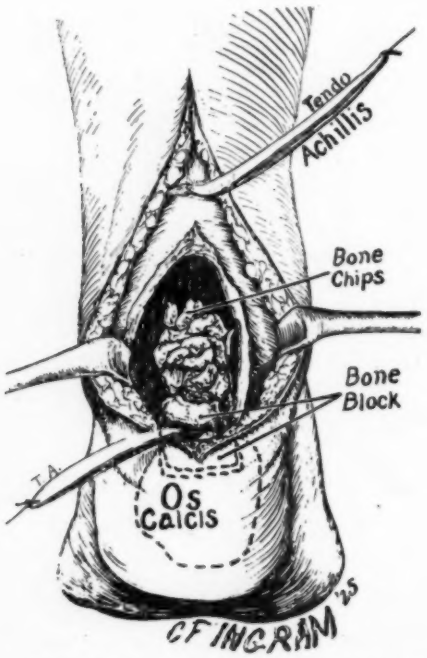

Fig. 3. Multiple bone grafts transplanted into pyramidal space.

convenient. It should extend from the superior aspect of the tuberosity of the os calcis upward for three or four inches in a straight line. If the tendo Achillis is contracted, severance is made by the plastic method. A straight incision is next made in the midline to the posterior portion of the ankle joint, retracting inward the tendon of the flexor longus pollicis. With a heavy periosteal elevator, a pyramidal space is cleared, exposing the posterior surface of the tibia, ankle joint, subastragalar joint and superior surface of the os calcis. The foot is dorsiflexed, bringing into view the posterior extremity of the astragalus and the posterior portion of the articular surface of the tibia. The posterior extremity of the astragalus is removed with a curved chisel, so as to permit close approximation of the graft and an intra-articular, as well as extra-articular block. A cavity is made on the superior surface of the os calcis just posterior to the ankle joint for reception of the large graft, as will be shown later. Bone is next transplanted from any portion of the skeleton. As it is usually necessary to enter the forefoot for the

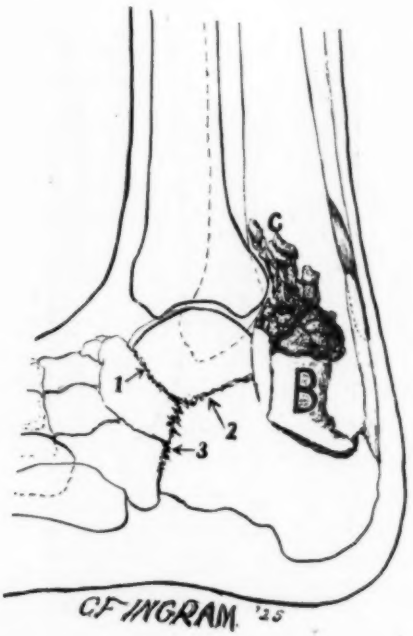

Fig. 4. Diagram, side view, showing bone-block in position approximate to and within ankle joint. B, bone-block. C, bone chips. 1. Astragaloscaphoid arthrodesis. 2. Subastragalar arthrodesis. 3. Calcaneocuboid arthrodesis.

purpose of stabilization by arthrodesis—bone is often excised in the process, and can be utilized as transplants. Spongy bone is believed to adapt itself more naturally than dense bone from the tibia, though a tibial transplant was successfully employed in one case and has been advocated recently by Leo Mayer. Transplants from the femur, when the case is complicated by genu valgum, and from the ilium, in transferring the crest in hip flexion contractures, have also proven satisfactory. If bone is excised from the forefoot, it is

denuded of cartilage, and a piece about one-half by one inch in diameter is placed in the cavity prepared on the superior surface of the os calcis, about which small particles are arranged in a pyramid. The cartilage is removed and placed in mosaic fashion to cover the posterior, inner and outer aspects of the pyramid, to prevent adhesion to surrounding structures; this step, however, is by no means essential, as the results are as good when bone is obtained elsewhere, free of cartilage. The

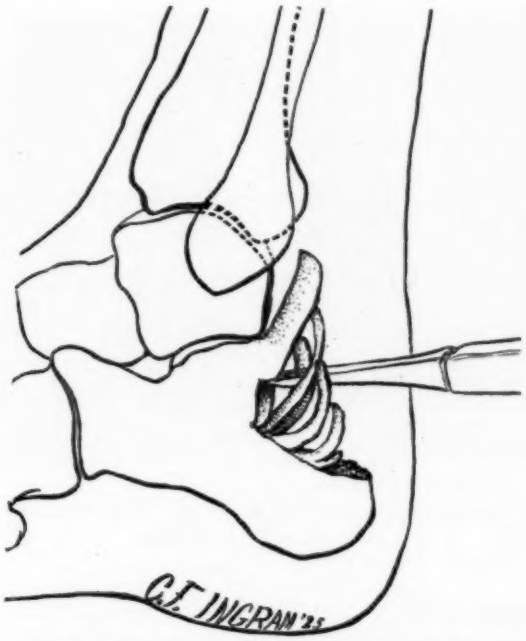

Fig. 5. Modification, which has proven satisfactory in a number of cases, by simply turning up a large flap from the os calcis.

soft parts are sutured snugly to retain the transplants in situ, the tendo Achillis is united, if severance is required, and the fascia and skin are closed. The foot is then held by a plaster cast at an angle of 90 degrees with the leg. Overcorrection is especially avoided, as it is preferable to secure a slight degree of plantar flexion in order to avoid flat sole or heel walking. At the end of eight weeks, the cast is removed and a roentgenogram is made, which usually demonstrates proliferation. A sequence of roentgenograms exhibits a gradual organization of bone, until there is a solid mass continuous with and forming a part of the os calcis and often fusing the os calcis to the astragalus, stabilizing the subastragalar joint. Plantar flexion is thus prevented, as the olecranon process limits extension of the normal elbow. The technique may be modified when the forefoot is stable, by turning forward the upper third of the os calcis, when, incidentally, it is possible to do a subastragalar arthrodesis, or even the horizontal section of Davis, with backward displacement of the foot by the posterior route.

It is also possible to transfer particles of bone from the midtarsal region through the subastragalar joint to the superior surface of the os calcis, in performing a triple arthrodesis, but the block cannot be so accurately placed as when the posterior incision is employed, and the results in a limited number of cases have been so unsatisfactory as to cause this method to be discarded.

Stabilization of the tarsus by osseous fusion, with correction of existing deformity, obviously renders the bone-block more effective. The extent of fusion required varies. In some cases, only the midtarsus, the astragalocaphoid and calcaneocuboid must be fused, whereas, in others, a triple arthrodesis is necessary, which is fusion of the calcaneo-astragaloid, calcaneocuboid and astragaloscaphoid articulations. Bony fusion is best accomplished in the following manner:

An anterolateral incision is made, beginning about one inch above and to the medial side of the fibula. This is carried straight downward to the anterior aspect of the external cuneiform bone. Through this incision free access is available to the astragaloscaphoid joint and the subastragalar and calcaneocuboid joints. The necessary amount of bone is removed at these points to correct the deformity, if present, after which the foot is displaced backward at the subastragalar joint, as far as possible. However, such backward displacement is often a myth, being more apparent than real; in fact, the removal of a section from the midtarsal region shor-

tens the forefoot and changes the relation between the forefoot and heel, giving the appearance of a backward displacement and a more prominent heel, in comparison with its appearance prior to operation. In order to obtain much backward displacement, there must be a dissection of the ligaments from both malleoli. This requires extensive dissection and is unnecessary when the bone-block is employed.

With the bone-block operation, a subastragalar fusion is accomplished; therefore, in a larger proportion, only the midtarsal region is attacked. In all cases where the astragaloscaphoid joint is fused, the corresponding calcaneocuboid must be fused in a like manner and great care must be taken in excising such an amount of bone as will permit coaptation of all raw bony surfaces and avoid dead space. After coaptation, in attempting to arthrodese these joints, osseous fusion will be brought about in a larger percentage of cases if the raw surfaces are roughened extensively with a chisel, so as to leave many small loose fragments. In applying the cast, close bony approximation at all points must be secured and maintained indefinitely.

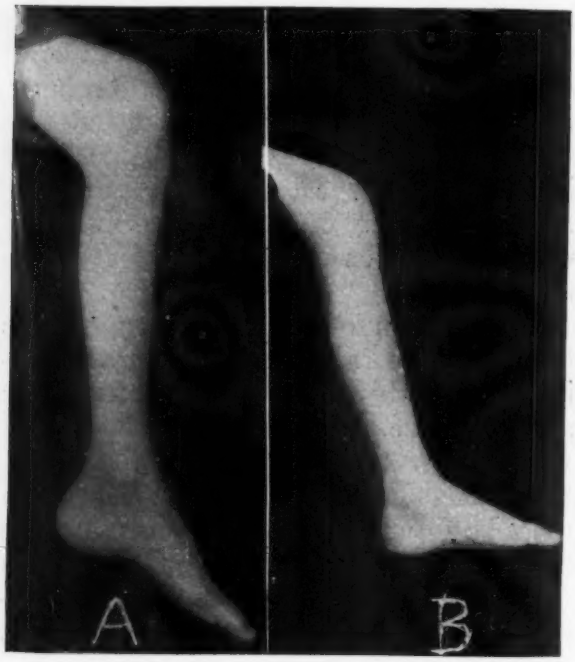

Fig. 6. A. Simple drop-foot in a child, resulting from anterior poliomyelitis. Note gravity causes equinus.
B. Same case, after arthrodesis of the midtarsal joints and bone-block. Note that foot is blocked at right angle to leg.

Tendon transference, when indicated, has been employed, also other procedures in the feet, as Steindler's operation for cavus and Dickson's operation for claw-toes, but these are dismissed with brief mention, as space will not permit full discussion of all collateral procedures.

As in all orthopedic affections, the after-treatment is most important. Success depends largely upon osseous fusion at various points. At the end of three weeks, the cast is changed and the position of the foot is noted, any irregularity being corrected. A roentgenogram is made to determine the relation of bones to each other. If, through error in the application of the cast and holding of the position of the foot, space between raw surfaces is permitted, approximation can be made at this time by slight force under gas anesthesia. Again, at the end of eight weeks, the cast is removed, when, by passive motion and the roentgenogram, progress of osseous fusion is ascertained. If this is efficient, drop-foot day and night braces are made and weight-bearing is permitted. If osseous union is retarded, the treatment should be the same as for delayed union in frac-

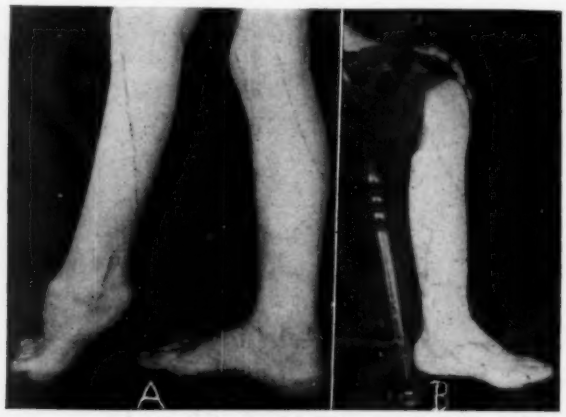

Fig. 7. A. Rigid equinus deformity of foot in a child following anterior poliomeylitis. Note contracture of tendo Achillis.
B. Same case, after triple arthrodesis, lengthening tendo Achillis and bone-block.

ture; the conditions are analogous. This treatment consists of the application of the third cast, great care being exercised in molding the arches. Weight-bearing is then permitted from four to six weeks, when osseous union is usually firm. The foot is protected by apparatus limiting plantar flexion until the roentgenogram demonstrates that osseous union is not only firm but well organized at all points and the structure of the bone approaches normal with decreasing osteoporosis. Close attention to such details increases the proportion of permanent and successful results. The roentgen ray should be employed routinely, as it is a most valuable agent in determining postoperative treatment, the prognosis and end results.

Fig. 8. A. Equinovarus deformity of right foot. B. Same case, showing an arthrodesis, drop-foot operation, and transplantation of tibialis anticus tendon to outer side of foot. Note foot blocked at 90 degrees on the leg.

The scope of the procedure is apparently not fully appreciated, though it was mentioned in the first report. The operation is employed not only in simple drop-foot, but whenever drop-foot is associated with other paralytic deformities. The indications are as follows:

1. Simple drop-foot, as a result of paralysis of the anterior group of muscles of the leg. The midtarsal joint is usually abnormally lax and requires stabilization, which necessitates the excision of bone that may be utilized as transplants.

2. Partial drop-foot, as evidenced by from 25 to 50 per cent of normal power, but not sufficient to dorsiflex normally. If the midtarsal joint is stable, the bone-block may be accomplished by turning forward a flap from the os calcis.

3. Rigid equinus. In this condition, the anterior group is partially, if not totally, paralyzed. Permanent limitation of plantar flexion prevents strain and increases endurance.

4. Equinovarus. The varus is corrected by tarsectomy, when sufficient bone is obtained for transference.

Fig. 9. Roentgenogram of foot after midtarsal arthrodesis and drop-foot operation. Note fusion of astragaloscaphoid and calcaneocuboid joints; also, osseous process fused to the os calcis and astragalus and projecting upward posterior to tibia.

5. Equinovalgus. When there is paralysis of the anterior muscles, a tarsal resection is often indicated in this condition. From the resection, sufficient bone for transference is available.

6. Flail-foot. As an addition to the Davis, Dunn, Ryerson or Hoke procedures, the transplant described above makes certain perfect stabilization. Backward displacement of the foot at the subastragalar joint alone will limit plantar flexion at times, but is not dependable.

7. As an adjunct to various combinations of tendon transference, especially the

reattachment of the extensor longus digitorum to the tarsal region.

8. Spastic paralysis, or hemiplegia, with overactive heel cord. In these, recurrence of deformities is notably frequent.

9. In children over eight years of age. Prior to this time, stabilization operations are rarely indicated.

In determining the end-results of the bone-block operation, much knowledge has been acquired in other phases of stabilization. Roentgenograms were made occasionally during the first two years after the operation was originated, but with increasing frequency. Since the past year, this method of investigation has been employed routinely in all operations for stabilization of feet.

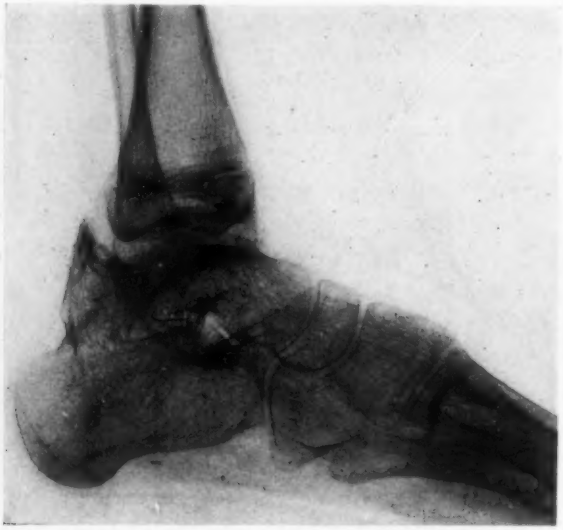

Fig. 10. Roentgenogram after drop-foot operation. This shows the posterior block which was obtained from turning of a flap on the superior surface of the os calcis. The tarsal region was not invaded.

Fig. 11. Roentgenogram of foot following triple arthrodesis and drop-foot operation. The process is too far posterior to the joint, but apparently the desired result was accomplished. This case also shows a marked degree of flat-foot, though solid bony fusion.

The clinical observations in 213 cases will be considered, but in only 86 of this number are roentgenograms available, for the reasons above stated. In every case accepted as to analysis of final results, clinical observations were made by my colleagues, Dr. J. S. Speed and Dr. Joseph I. Mitchell, and in most instances, by one of my colleagues and myself; no hearsay evidence, by letter or otherwise, has been accepted.

The cases of children and adults will be separately considered, as the bones of the developing organism are different in quality from those of a matured adult, and the growth element may affect the permanency of results of any surgical procedure.

Of the 213 cases in which bone-block operations were employed, 104 were in children and 109 in adults. Of the 104 in children, 76 met all requirements in determining the end-results, while in 28, either sufficient time had not elapsed since operation to reach a conclusion, or the patient was not available for observation. Of these 76, 71 obtained excellent results, the bone-block being effective and preventing plantar flexion by impingement of the block either against the posterior aspect of the tibia or the rim of the posterior extremity of the articular surface of the tibia. There were 5 failures, 3 of which were due to improper technique at operation, as demonstrated by the roentgenogram. The transplants in these were either insufficient or were placed too far posterior to the ankle joint to be effective in preventing plantar flexion. In one, a good result was apparent after a few months, with a

gradual dropping of the foot downward, though the size and relation of the bone-block was satisfactory. This apparent relapse was caused by increased relaxation of the ligaments of the ankle joint, as the triple arthrodesis was united by osseous fusion. In one, the ligaments were intact and the bone-block in place, but apparatus was discarded too early, with the result that the unorganized graft and callus permitted plantar flexion by the constant force of gravity and consequent recurrence.

Fig. 12. Roentgenogram of foot following drop-foot operation. Most efficient mechanical blocking was obtained.

However, the roentgen-ray pictures demonstrated an apparently good result.

In 5 cases, the forefoot possessed normal stability, hence the bone-block was made by turning up flaps from the posterior surface of the os calcis. Four were successful and one was a failure, on account of error in operative technique. In 6 children, the operation was bilateral and carried out at different sittings, each foot being estimated as a separate operation. In 2 there was fusion of the block to the posterior aspect of the tibia, causing a solid bony ankylosis of the ankle joint. This is an undesirable complication and was probably due to unwarranted trauma to the posterior surface of the tibia. However, this is a splendid method of extra-articular fusion of the ankle joint and has been utilized by the author in other affections, such as tuberculosis.

In 4 children, the anterior block was employed to prevent excessive dorsiflexion or calcaneus. This was apparently effective in one case; in the other three, the calcaneus was corrected by the triple arthrodesis and backward displacement of the foot, but the block was ineffectual. The block is

Fig. 13. Roentgenogram of foot following midtarsal arthrodesis and drop-foot operation. The mass of bone is well placed and blocks gravity flexion, but is not united by bone to either the astragalus or the os calcis. Note grotesque proliferation.

not recommended in such conditions, though there are other recognized measures which are effective.

One negro child died of tetanus one week after operation. This boy had been barefoot for several months prior to operation and had a skin eruption of mild type, for which he was treated in bed for ten days before operation. Since this catastrophe, anti-tetanus serum is routinely administered in an immunizing dose prior to all operations on the feet of children who have been running about barefoot.

In 11 children, varus of the forefoot developed after operation, but in only a small number of these was the degree of

sufficient severity to warrant treatment. Slight varus is not incompatible with good functional result. In one, there was marked valgus, though a stable foot was obtained with an efficient block.

In estimating the postoperative progress by the roentgenogram, there are three chief factors to be considered: the bone block, arthrodesis of the tarsus and the position of the foot.

The bone-block, to meet all requirements, should follow the prescribed dicta: The osseous process should be well organized, of sufficient dimension, of close approximation to the posterior aspect of the ankle joint, and fused by bone to the posterior extremity of the astragalus and the superior surface of the os calcis. The efficacy of the bone-block can, in 95 per cent of cases, be determined by roentgen ray, but in a small number, plantar flexion may be limited by adhesions or scar tissue. Conversely, it has been found that a bone-block may be observed which meets all requirements from the standpoint of the roentgenogram and yet does not prevent plantar flexion. This may result from relaxation of the ligaments of the ankle joint, with failure of fusion in the tarsus, and is usually observed in individuals with congenital relaxation of joints who are affected with poliomyelitis. In this well-kown relaxed type, end-results of all stabilization operations are less successful and recurrence of deformity is more common.

In the cases of 33 children, roentgenograms were made to determine the results. In 25 of these, the bone-block met all requirements of the prescribed dicta. Five met all requirements except one, but the block was efficient in preventing gravity flexion. In 1 of the 5, a large mass of bone was found posterior to the ankle, but not united to any adjacent bone. In 2, the block was entirely absorbed; in one, the block was too far back, though efficient; and, in one, the block was deficient in dimension.

In order to improve function in paralytic feet, stability is essential. In this series, stability has been acquired by arthrodesing operations on the tarsus; a description of the procedure was outlined previously.

Unless osseous fusion is attained, the chances of permanent success are diminished and the degree of osseous fusion may be taken as an index of success. Fibrous union of the tarsal joints lessens endurance, with a more probable complication of pain from foot strain thereafter. However, an excellent functional result is not incompatible with a strong fibrous union.

Of the 33 children of whom roentgenograms were made, triple arthrodesis was employed in 21; in 2 of these, union was part fibrous and part bony; in 2 there was non-union or fibrous union. In 7, fusion was attempted in the midtarsal joints, astragaloscaphoid and calcaneocuboid. In 5 there was osseous fusion throughout; in 1 case the calcaneocuboid was fused by bone and the astragaloscaphoid by fibrous union. In 1 there was fibrous union of both joints. The roentgenogram will determine only the structure of the longitudinal arch. Of the 28, in 2 the arch was obliterated, there being extreme flat-foot, which could have been avoided by routine after-treatment, as above described. Unless varus is extensive, the roentgenogram is of little value as a determining factor.

Of 109 adults, the ages ranged from fifteen to sixty years, but a very large percentage were under thirty, and a very small number over forty. Eighty-six met all requirements and received careful personal observation, with notation. Of this number, there were 83 with efficient block, preventing gravity flexion, while 3 failed. The causes of failure in adults were the same as mentioned in reviewing the cases of children. The results in adults after six months may be regarded as definite and conclusive. In 8, the operation was bilateral and at different sittings; these are counted as two operations.

After operation, 5 developed varus, 2 of these to such a degree as to warrant a second operation. Two had marked planus. Pain persisted in the tarsus over one year

in 4, then gradually subsided. In 4, pain persisted in the heel, but in one did not abate at the end of one year. The roentgenogram of this case did not demonstrate excess bone, nor was there any apparent mechanical pressure. However, a portion of the bony process was excised with complete relief. The pain in the tarsus could not be ascribed to the bone-block operation, but must be regarded as a sequence of triple arthrodesis, as pain may be a persistent symptom after any reconstruction operation on the foot of an adult. In 1 case there was a fracture of the block, which gave pain for a few days, after which recovery was uneventful. This can be prevented if the process is not made too slender at the point.

Postoperative roentgenograms were made in 54 adults from six months to four years after operation. The bone-block conformed to all requirements in 42. In 9, the bone-block was efficient, but failed to unite at one point, either the posterior aspect of the astragalus or the os calcis. In 4 the bone-block was deficient. The triple arthrodesis was not necessary in so large a proportion of cases in adults, but was employed in 29, in 3 of whom the roentgenograms showed that bony fusion was doubtful. In 16 with arthrodesis of the midtarsal joints alone, 3 showed part bony fusion and part doubtful fusion, or probably fibrous fusion. Four showed fibrous fusion or nonunion. Taking the series as a whole, 43 showed osseous fusion, 3 partial osseous fusion, and 7 probable fibrous union.

In adults, the roentgenograms revealed 8 in whom the longitudinal arch was obliterated and the feet were flat. This, as in children, could have been avoided by the detailed routine after-treatment above described. By such observations, the routine after-treatment was evolved. Flat-foot as a result, while undesirable, may give excellent function, provided osseous fusion is firm.

The chances of permanent success without recurrence in all operations for paralytic feet increase proportionately with the age of the patient, and this is true with the bone-block operation, as with the arthrodeses. However, if comparison is made between adults and children, it will be observed that in children the ratio of success to failure of the bone-block was 71 to 5, while in adults the ratio was 86 to 3. This, reduced to percentage would be in children 92.8, and in adults, 96.5.

The morphology and the mechanics of the bone-block have been the same in children as in adults. This offers a most instructive study in osteogenesis, with variations in structure which may be enumerated as follows:

1. The common type is an osseous process fused to the os calcis and astragalus, prolonged backward on the superior surface of the astragalus and extending upward at right angles posterior to the tibia, so as to block within the joint and also posterior thereto.

2. The posterior aspect of the astragalus is enlarged by the process, blocking within the joint.

3. A process attached to the upper surface of the os calcis, extending upward with the posterior surface of the os calcis, preventing plantar flexion by impinging upon the posterior surface of the tibia, being entirely extra-articular.

4. The posterior surface of the astragalus is enlarged and extended backward, but conforming to the anatomical shape of the posterior extremity of the astragalus.

5. Grotesque and marked proliferation of graft.

6. A longitudinal mass of bone, well placed and blocking gravity flexion, but not united by bone to either the astragalus or the os calcis.

7. The bone-block fused to the tibia, os calcis and astragalus.

Of 76 children, there were 11 in whom varus recurred or developed after arthrodesis of the midtarsus or triple fusions, while in adults only 5 of the 86 observed developed varus. It is quite obvious that the relative comparisons as to osseous

union between the bone-block and arthrodesis of the tarsal joints in adults and children are favorable to bone-block. Taking the entire number of children and adults examined, 162, there were 154 successful with efficient bone-block, only 8 having failed; or, approximately 96 per cent were successful.

The tables graphically demonstrate the comparative results between adults and children, from both the roentgenological and clinical manifestations:

The objections that have been made to this procedure have been only theoretical. The probability of pain from pressure has been suggested. From the 162 cases reviewed, this has been a symptom in only 4, none of whom were children. In only 1 case has there been persistent pain, which was relieved, as above stated. Pain is a symptom which has been persistent after any reconstruction operation on the foot, and as is demonstrated in this series, occurs with equal frequency in the midtarsus

ROENTGENOGRAPHIC DEMONSTRATION

	Total number	Bone-block efficient. Osseous fusion complete	Bone-block efficient. Osseous fusion partial	Bone-block deficient	Triple arthrodesis. Osseous fusion complete	Triple arthrodesis. Osseous fusion partial	Triple arthrodesis. Non-union	Mid-tarsal arthrodesis. Osseous fusion complete	Mid-tarsal arthrodesis. Osseous fusion partial	Mid-tarsal arthrodesis. Non-union	Position flat
Children.....	33	25	5	3	17	2	2	5	1	1	2
Adults.....	54	42	9	4	29	2	4	14	3	4	8
	87	67	14	7	46	4	6	19	4	5	10

CLINICAL RESULTS

	Total number	Conformed to requirements	Bone-block efficient	Bone-block deficient	Post-operative varus	Post-operative valgus	Pain in heel	Pain in tarsus	Fracture of graft
Children.....	104	76	71	5	11	2	0	0	0
Adults.....	109	86	83	3	5	8	4	4	1
	213	162	154	8	16	10	4	4	1

Estimation of the end-results of the combined procedures of the posterior block and arthrodesis, or other measures, can be reached only in a very general manner, as there are many factors to be considered. Nor are the notes definite on all points, though, roughly speaking, we may consider 80 per cent excellent and 15 per cent improved, with 5 per cent unimproved. There have been few complications; the usual slow healing and superficial sloughs have been found, as in all procedures on paralytic feet, but infections were rare and there were no serious results attributable to operation.

from arthrodesis, as in the heel from transplanted bone. The second objection is that arthritis might be developed by the bone-block being so near the joint. In answer to this, refutation can be made by the fact that, of the 162 cases reviewed, none has shown the slightest evidence of subsequent arthritis. This objection is based on the assumption that joints which have a bone-block following fracture often develop arthritis. In the first place, all such joints do not have arthritis, and in the second place, there is no analogy, as joints in fractures are usually severely traumatized, with reaction, as denoted by callus about or

within the joint. No real adverse reports have been made. In the bone-block operation, there is no occasion to traumatize the joint. It has also been stated that the operation is too radical, but the results herein reported, as well as those of others, completely refute such a statement.

Mr. Robert Ollerenshaw before the meeting of the British Orthopaedic Association, October, 1925[1] reported a series of 20 cases, of which he demonstrated the results in 8. He employed a bone graft in 2 cases which had a fractured tip. In my one case, no treatment was given. As stated previously, this can be averted if the process is not made too slender at the point.

In 1924, Dr. Dickson and Dr. Diveley, of Kansas City, reported 25 cases, with excellent results in all. Dr. Henderson and Dr. Meyerding, of the Mayo Clinic, reported a series of 8 in 1924, with excellent results. Dr. Leo Mayer, of New York, has also had a number of successful results from this operation. Others from various sections of the country have made individual reports of satisfactory results. In fact, it is quite apparent that the procedure has been of value in practically all paralytic deformities of the feet, with the exception of cavus, calcaneus and calcaneovalgus. The advantages of the operation are:

1. It has simplicity, as the transplants are usually available from associated procedures.

2. Apparatus may be discarded, as an internal brace is constructed.

3. Muscle power is conserved, by preventing the constant pull of the pendulous foot by gravity.

4. Constant prevention of overstretching may of itself induce a return of dormant muscle power.

5. As the functional demands are decreased, feeble power may be cultivated.

6. Rocker motion of the ankle joint is conserved.

7. Stabilization is rendered more effective by the bone-block and additional fusion of the astragalus and calcaneus through the block. The percentage of satisfactory and permanent end-results is thus materially increased.

[1] Ollerenshaw, R. Surgical treatment of tangle-foot. *Brit. Med. J.*, 1926, i, 525.

Discussion

Dr. Leo Mayer: This is a beautiful piece of work. We have, I think, worked out successful methods for very badly paralyzed feet, so that we can assure our patients in advance that they are almost sure of getting good results. This is a very definite and radical advance which has occurred during the past ten years and is largely due to the work of Dr. Campbell in this field. I should like to ask him whether, where there are two strong peroneal tendons, best results are obtained not by bone-block operation but by tendon operation, in this case by transplanting the two peroneal tendons to the dorsum of the foot, the longus to the inner side, the brevis to the outer side. By this one will get a very excellent dorsal flexion. By combining this operation with an arthrodesis of the joint between the os calcis and the scaphoid, one secures a stable foot which has good dorsal motion and plantar flexion. Where the peroneal tendons are not present, the only way to get results is by well-constructed bone block. Instead of using a series of bone chips as in the typical Campbell operation, I have taken, one large graft from the anterior surface of the tibia, and have then inserted this graft into the upper surface of the os calcis. My impression from the study of my own roentgenograms is that this method is not as good as Dr. Campbell's. Although this method holds the foot in fair position, it does not suffice when it is standing against the pull of a rather strong Achilles tendon.

Dr. Samuel Kleinberg: I am not quite clear as to what to include in the type of cases in which Dr. Campbell performs this operation. I should like to know whether he advises this procedure where there is a calcaneous condition. I should like to know whether it can be used in a trauma, an equinus, varus or valgus, or a combination of all. If there is as much valgus or varus deformity as there is equinus, then why is not the Hoke's operation preferable? I would ask Dr. Campbell in using bone chips to establish the block is it necessary to remove cartilage from the bone that is used?

I can see clearly where in a number of cases of equinus we were somewhat at sea as to what to do, I know now that we should have used the bone-block operation. In the future I shall be very enthusiastic about it.

Dr. Robert Humphries: I think I am the only one here who has done this bone-block operation, and have seen a number of cases followed with very good results. There is no pain and it has held up the foot very satisfactorily for periods of two or three years after I have used it. I have had no such proofs as Dr. Campbell, but my own observations have been very satisfactory.

Dr. Campbell (closing): I thank you for your liberal discussion particularly at this late hour. I shall not go into details because of it, but in answer to Dr. Mayer, I feel that in connection with transplanting of tendons, wherever you use a tendon to lift up the foot, you may get very excellent results that may be permanent in many cases, but we have seen a number of cases which acted beautifully for one or two years or for quite a while, but ten years later, after constantly bearing weight and being used, the muscle became stretched, because that is more than any transplanted muscle can really accomplish. The bone-block operation forms a permanent bony process with limited plantar flexion. It is not necessary to have full plantar flexion in this case. In answer to Dr. Kleinberg, in a case of equinus, I lengthen the heel cord where it is tight, and if it is rigid, I do it at the same time as I make the bone-block. I always lengthen where there is the slightest contracture of tendon. As to calcaneus I tried the operation in five or six cases and found it an absolute failure. You ask about other deformities of the feet. Whenever I have to deal with an equinus, whether valgus or varus, I use bone-block. If bone is excised from the forefoot it is denuded of cartilage, and this removed cartilage is placed in mosaic fashion to cover the posterior, inner and outer aspects of the pyramid to prevent adhesion to the surrounding structures. You can pull it off with a knife, or you can shave it off. This step, however, is by no means essential, as results are as good when bone is obtained from elsewhere free of cartilage. Regarding the question of pain, should pain persist, we could remove a portion of the new process. I have had to do it in but one case out of the 162 that have been mentioned here.

PRESENTATION OF CASES

RECURRENT DISLOCATION OF THE PATELLA. OPERATION

SAMUEL A. JAHSS, M.D.

(By invitation)

This girl, aged sixteen, came to the Hospital for Joint Diseases in August, 1926. In June, 1926, while running, she felt something snap in her right knee. She could not bend her knee although the entire phenomenon was not accompanied by much pain. She saw that the right knee was much broader than the left, and she also noticed something sticking out on the side of the joint (external). She straightened her knee, and this protrusion snapped back into place, without manipulation. This occurred two or three times a week for about eight weeks. (June to August.)

She was operated upon August 18, 1926, by the Albee modification of the Jones operation in which the trochlear surface of the external condyle was osteotomized and a triangular bone graft (from the tibia) was inserted into the space between the fragments of the condyle in order to raise the trochlear surface and prevent dislocation from taking place. This procedure is recommended in cases where the external condyle is much flatter than the internal one, a condition present in the congenital type of case. Although the transposition of part or the whole of the ligamentum patellae is advised (A. G. T. Fisher) in cases that are *not* congenital (in which group the present case belonged), this procedure was not followed because recurrences are reported quite often when the soft structure operation alone is performed. The result has been most satisfactory. The patient has a normal range of motion and has had no recurrence since the operation, a period of seven months.

BILATERAL COXA VARA OF UNKNOWN ORIGIN

JOSEPH G. WISHNER, M.D.

(By invitation)

N. D., aged seven years, was admitted to the Hospital for Joint Diseases in May, 1926, on the service of Dr. Leo Mayer. She had been sent there by the school doctor who, in the routine examination when the child first entered school, discovered peculiarity in walk-

ing and limitation of motion at the hips. She is the seventh child of her mother, and was delivered at term as a normal head presentation without any difficulty. She weighed ten pounds at birth. During her infancy she was breast-fed and bottle-fed. The first tooth appeared at seven months. She began to walk at eight months. She talked when one year old. There was at no time during her infancy any sign or symptom of rickets. There were none of the acute infectious diseases of childhood until the age of three, when she had a mild pertussis, and at six when she had varicella. The mother states that the baby walked normally, that is like all other children, until she was three years old. During this time she fell frequently but not severely. The mother attributed the frequent falling to lack of proper attention and not to any illness or abnormality. At no time was the child laid up or disabled. When three years old there began peculiarity in walking, and at that time the mother recalls the baby did complain of occasional fatigue. Still no medical aid was sought because the parents thought the gait only slightly abnormal, and hoped it would improve with time. When the child entered school at the age of six the school physician discovered the real state of affairs.

Examination on admission showed a marked lordosis with the waddling gait so characteristic of bilateral congenital hip dislocation. Both trochanters were high but on the same level. The lower extremities were of equal length. Abduction of both legs was limited at five degrees, and there was flexion contracture of 15 degrees at both hips. All other motion at the hip was normal. Wassermann reaction negative. Although our first impression was that the condition was one of congenital dislocation of the hips, limitation of abduction and flexion contracture established the diagnosis of bilateral coxa vara.

The roentgenogram (Fig. 1) shows coxa vara with peculiar disturbance at both upper femoral epiphyses. There is an interruption in the continuity of the neck, but the periosteum at the lower border is still intact. The etiology is not quite clear. This case corresponds very closely with several described by R. G. Elmslie as idiopathic coxa vara of the infantile type, with fibrous intersection at the neck. In his cases, the onset was likewise insidious, the age was between three and six, and all had lordosis and flexion contracture at the hips. The roentgen-ray pictures were exact replicas of the one in this case. Mr. Elmslie, however, after considerable pathological and anatomical work could not arrive at a definite causative factor. He suspected a maldevelopment in the upper epiphysis of the femur with weight-bearing as the deciding factor. In our case, there was no trauma at birth and rickets was ruled out. It is possible that the frequently repeated injuries during the first three years were sufficient to cause this downward displacement of the head and neck, a weak or undeveloped neck being a predisposing factor. After this, the body weight was sufficient to cause further

Fig. 1. Bilateral coxa vara due to giving-way of neck. Loss of continuity except at lower border.

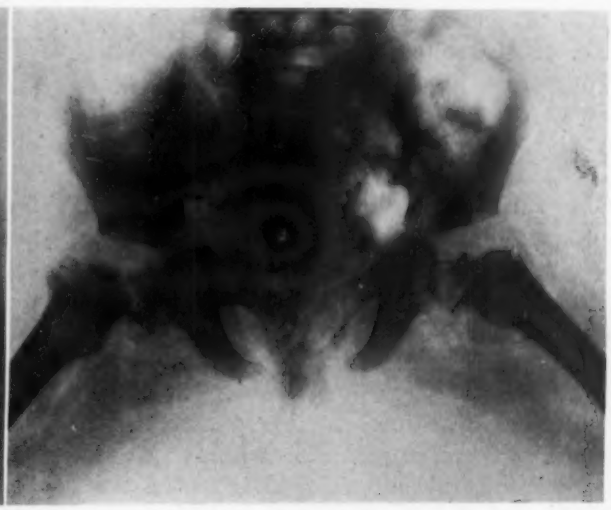

Fig. 2. Bilateral wedge osteotomy through greater trochanter correcting coxa vara.

downward displacement of the head and neck. Since bone development begins and proceeds from the lower part of the neck, here the periosteum and a thin layer of bone may remain intact. This type is to be differentiated from the congenital type of coxa vara which is evident as soon as the child begins to walk. In these cases there is no abnormality in the development of the neck of the femur. In the infantile type, the so-called fibrous intersection of the neck has been demonstrated by R. Jones and Elmslie, and the specimens they have show the presence of other congenital abnormalities. In rickets, the roentgenogram is entirely different. There is a bowing of the whole neck along with an antero-external bowing of the upper end of the femur. Also in these cases there is usually no limitation of motion at the hip.

Treatment consisted in cuneiform osteotomies through the greater trochanter and correction of the flexion contracture at the hips (Fig. 2). The child can now abduct to 45 degrees. The lordosis is only partially corrected but is now being treated with exercises. There has been an increase of one-half inch in the length of both lower extremities. The height of the child has increased three-quarters of an inch. Her general appearance is suspicious of a thyroid or multiple endocrine gland disturbance. For this reason, we have prescribed thyroid extract, ½, three times a day for the past eight months. Whether the endocrine disturbance is a factor in this case I cannot say. Roentgenograms of other joints and long bones show nothing abnormal.

BIFURCATION OPERATION

(THREE CASES)

WALTER I. GALLAND, M.D.

Case 1. M. S., aged eleven years. Infectious epiphysitis at the head of the right femur at the age of three years completely destroying the head and neck of the femur. Admitted to the Hospital for Joint Diseases September 18, 1925. Chief complaint, limp and shortening of the right lower extremity. On admission had a severe right hip limp. This hip was in 30 degrees of flexion contracture. There was a shortening of 2½ inches of the right lower extremity which was extremely atrophic, a "match-stick leg" due to disease. On September 14, 1925, a Soutter fasciotomy was performed, and the flexion contracture was corrected. The child was then placed in suspension-traction and the shortening was reduced about ¾ of an inch. On April 1, 1925, the bifurcation operation was performed through a five-inch incision beginning at the tip of the greater trochanter, and extending down the antero-lateral aspect of the thigh. The femur was exposed and divided obliquely with an osteotome at the level of the lesser trochanter. The upper end of the lower fragment was dislocated into the acetabular region by abducting the extremity and guiding the fragment into position with the forefinger. The trochanteric fragment was adducted by digital pressure. The extremity was placed in a plaster spica to the toes with the hip in 10 degrees of flexion and slight external rotation and 40 degrees of abduction. There was no postoperative shock. Weight-bearing was permitted in plaster after four weeks. The spica was shortened to the knee after six weeks, and removal 11 weeks after the operation. The hip now functions painlessly. There is 1 inch of shortening; flexion is free to 90 degrees, abduction to 40 degrees. Rotation is moderately free.

Case 11. Mrs. A. M., aged fifty-four years. Admitted to the Hospital for Joint Diseases, October 12, 1926. Chief complaint, pain in left hip. The left lower extremity was held in external rotation. The extremity showed an actual shortening of 1½ inches. Flexion was limited to 15 degrees on account of pain, abduction limited to 30 degrees. The greater trochanter was elevated above Nélaton's line. Sliding motion of the femur was present. Roentgenogram showed ununited fracture of the neck of the left femur. The patient was placed in preliminary suspension-traction, and the shortening was somewhat reduced. She was in poor physical condition on admission and was not considered a good operative risk. A large mass was present in the right iliac region—a polycystic kidney.

Operation, November 4, 1926: The left femur was bifurcated through a six inch incision beginning at the tip of the great trochanter as in Case 1. The osteotome was directed upward and inward into the lesser trochanter from a point four fingers below the tip of the greater trochanter. The upper end of the lower fragment was dislocated and guided with the forefinger into position just below the "chin" of the head of the femur. The trochanteric

fragment was adducted by digital pressure. Plaster spica applied to the toes, with the hip flexed 10 degrees, abducted 40 degrees, and the thigh in slight external rotation. Patient bore weight in the spica twenty-three days after operation. Spica shortened to knee six weeks after operation, and removed three months after operation. Patient has had no pain since operation, flexes thigh 10 degrees past right angle. Abducts to 35 degrees. Rotation moderately free. Shortening 1 inch.

Case III. Mrs. R. A., aged forty-six years. Chief complaint, pain in left hip. Has had a a painful osteoarthritis of the left hip for the past nineteen years, and has been treated in many institutions without relief. Roentgenogram shows marginal dislocation of the head of the femur due to wandering of the acetabulum. The hip was so painful that she could not walk across the room. Had a severe limp. In this case, the bifurcation was done for the relief of the pain rather than for any cosmetic purpose. By bifurcating the femur in this case the osteoarthritic head is relieved from weight-bearing, and simply becomes a part of the trochanteric muscle lever fragment. The body weight is borne on the diaphysial or distal fragment. Operation May 13, 1926. Bifurcation of the left femur by the same technique as in Case II, the proximal end of the lower fragment being guided into position just below the chin of the head. Plaster spica including the toes. The patient was discharged from the hospital July 8, 1926, and disappeared from observation until March 18, 1927, when she came to the out-patient department walking without pain and with a slight hip limp, extremely grateful for the relief obtained. Flexion of the hip to 10 degrees past right angle, abduction unlimited, rotation free, no pain.

STENOSING TENDOVAGINITIS

DR. H. C. STEIN, M.D.

(By invitation)

There is a very painful and disabling condition about the wrist, which is encountered rather frequently, and although described many years ago has not been described in American literature. There is no reference to it in our textbooks or medical journals. We were able to find six references in foreign literature. It was first described by de Quervain in 1895 in *Correspondenzblatt für Schweizer Aerzte*. He reported at that time two cases that he operated upon, and three nonoperative. Weti in 1896 described one operative case. Marion of Paris in 1903 described six nonoperative cases. Poulsen of Copenhagen in 1911 described ten nonoperative cases. Michaelis in 1912 described one operative and two nonoperative cases. De Quervain in 1912 added eight operative cases to his previous report. Thus, there are reports of only twelve operative and twenty-one nonoperative cases in the literature.

This condition occurs in the first compartment of the posterior annular ligament through which the tendons of the extensor brevis pollicis and abductor longus pollicis pass. Cases of this kind are not very amenable to conservative treatment. The symptoms resulting are out of proportion to the extent of the lesion. We had a number of these cases several years ago in which we tried various forms of conservative treatment such as diathermy, forcible abduction, casts, etc., without much success. This condition is readily cured by a simple operative procedure. Recently, we operated on four such cases at the Hospital for Joint Diseases.

As a tendon passes around a curve it passes through a fascial pulley, which in this condition is the first compartment of the posterior annular ligament. In order that there should not be too much friction against this pulley a tendon sheath filled with synovial fluid exists which extends above and below this pulley. (The mechanism of this sheath has been described by Dr. Leo Mayer.) Normally, this pulley, which is called the tendon fascia, is thin and elastic and with the fluid in the tendon sheath permits the tendon to glide back and forth without resistance. An 18F or 20F sound can be passed through alongside the tendons. In this condition the tendon fascia undergoes changes similar to those in Dupuytren's contracture of the palmar fascia. In a well-developed case the tendon becomes markedly constricted and compressed by this tense fascia, reducing its caliber often-times to one-quarter its original size. It is constricted both laterally and anteroposteriorly. The tendon fascia is very much thickened and inelastic, very dense and does not even permit the passage of a fine probe without much force. The constricted tendon is frayed, loses its luster, and is sometimes covered with a fine granulating tissue or gritty substance. Immediately distal to this constriction a bulbous enlargement of the tendon exists extending

downwards one-quarter to one-half inch. Microscopical examination of sections of strangulating fascia showed various stages of inflammatory reaction. In the acute and earlier cases hemorrhage and numerous young fibroblasts studded by round cells of fibrin production were found. In the more advanced cases cartilaginous and calcareous changes were found.

The subjective symptom is very severe pain radiating from the region of the radial styloid down the thumb and up to the elbow, and in one case up to the shoulder. Pain is aggravated on grasping objects, and is often so severe as to cause the patient to drop the object he is holding. During the night, pain is often so acute as to cause loss of sleep, and relief is obtained by resting the arm in a fixed position on a pillow. On examination in most cases there is little to be found except severe tenderness over the region of the radial styloid. Occasionally, a little edema of the annular ligament is present. Bulbous enlargement distal to the ligament can frequently be felt. Forced ulnar flexion of the wrist causes severe pain.

The first compartment is not the only place where this lesion occurs. We have had exactly the same condition occurring in the fifth compartment through which the extensor carpi ulnaris passes; and this case was diagnosed before operation by the analogous symptoms on the ulnar side. As far as I know, it is the first case of this nature ever reported.

This condition is usually incorrectly diagnosed, being most commonly mistaken for periostitis of the radial styloid, although roentgen-ray examination in all cases is negative. Some are treated for rheumatism, neuralgia, etc.

Surgical treatment consists in freeing the bound tendon either by dividing the stenosing fascia by a simple incision, or by removing a section from the external wall of the compartment or by extirpating the entire fascia. Subcutaneous division has been reported with successful results.

Case I. S. L., aged forty years, painter, had the condition for four months: severe pain radiating the elbow, extreme tenderness at the tip of the radial styloid, forcible ulnar flexion of the hand painful. Could not work. Operation. Cure.

Case II. E. B., aged thirty-six years, houseworker. Complained of severe pain in the left wrist for six months, radiating down to the thumb and up to the shoulder. Attributed her condition to wringing clothes. Prior to operation could not sleep and could not do her work. Operation eight months ago: external fascial wall excised. Complete cure.

Case III. L. W., aged twenty-four years, houseworker. For three months prior to operation had severe pain in the right wrist extending down to the thumb and up to the elbow. Operation six months ago: fascial wall excised. Complete cure.

Case IV. J. C., houseworker. Pain over the left radial styloid radiating to thumb and elbow. Attributes her condition to fall on the tip of her left thumb. Could not do her housework. Had to keep her wrist supported by pillows at night. Operation two months ago with local anesthesia. The instant the stenosing fascia was incised patient remarked that she felt everything went back in place and her arm felt fine. Has had no pain or other symptom.

Case V. E. N. Attributes her condition to a fall. Had symptoms for three years preceding the operation; very severe pain over the ulnar styloid. Extreme tenderness was found over the tip of the ulnar styloid in the region of the fifth compartment. Slight edema in this region. A diagnosis of stenosing tendovaginitis of the extensor carpi ulnaris was confirmed at operation two months ago. Fascial wall excised. Complete cure.

In conclusion I would like to emphasize that in all cases of acute tenderness of the radial styloid with negative roentgen-ray findings a diagnosis of stenosing tendovaginitis is to be considered.

I wish to thank Dr. Harry Finkelstein and Dr. Henry L. Jaffe for assistance and suggestions in the study of these cases.

WHITMAN RECONSTRUCTION OPERATION FOR UNUNITED FRACTURE OF THE HIP

ISADORE ZADEK, M.D.

A girl, sixteen years old, was admitted to the Hospital for Joint Diseases in July, 1926, with the complaint of pain and disability affecting the lower right extremity and to a less extent the left. Four weeks prior to this, the patient slipped but did not fall, and was not completely disabled at any time. Further questioning disclosed the fact that she had never been quite so active as other children of her age. Examination showed a girl in good condi-

tion but of small stature, who walked with a marked bilateral limp, more marked on the right than on the left side. There was exaggeration of the lumbar lordosis, the right hip in 15 degrees adduction and flexed to 120 degrees. The greater trochanter on this side was elevated and prominent. There was moderate sensitiveness over the front of the hip joint. No abduction was permitted. There was apparent shortening of an inch and a quarter, and a measured shortening from the anterior superior spine of the ilium to the internal malleolus of a quarter of an inch. No abduction was permitted on the right but flexion was permitted to 90 degrees on both sides. Left hip: Abduction was permitted to 15 degrees and flexion likewise permitted to a right angle. A roentgenogram at this time showed a bilateral coxa vara with the greater trochanters pointed and curved—of the "beak" type. There was ununited fracture of the right femur with absorption of practically all of the neck and upward displacement of the shaft. A few days after admission to the hospital the typical Whitman reconstruction operation was done, the head fragment being removed and the remodeled neck placed in the acetabulum, the greater trochanter being displaced to a lower level. The articular cartilage was absent from a considerable portion of the head of the femur, and its surface contour was irregular. A plaster of Paris spica was applied with the hip in 25 degrees abduction. The subsequent course was uneventful. Examination at the present time discloses the hip in 15 degrees abduction and flexion to 160 degrees. There is not more than 10 degrees movement in any direction permitted. The patient is satisfied with the result; she states that she has complete relief from pain and is able to walk twice as far as she could prior to examination.

While I have had no elaborate experience with the reconstruction operation, the cases that I have seen have shown a distinct tendency to have the adduction recur, and while some of the patients get a fair amount of movement it would seem that limitation of movement is to be expected and that the end-result is a fibrous ankylosis. One would expect the hip to go into adduction again because the remodeled neck fragment is so short. It seems hardly reasonable to expect that a transplantation of the muscular attachments with the greater trochanter to a level a couple of inches lower would have any great influence in preventing adduction when we have the long opposing adductors inserting at a lower level.

DELAYED ULNAR PALSY. OPERATION

HARRY FINKELSTEIN, M.D.

I. A., aged thirty-seven years, was admitted to the Hospital for Joint Diseases February 7, 1927. He fractured his right elbow six and one-half years ago. He was treated for nine weeks at the Lincoln Hospital, then at the Hospital for Joint Diseases, for several weeks; received baking, massage and manipulation. The elbow remained partly stiff. Flexion was possible to about 100 degrees, extension to 120 degrees. Pronation and supination were unimpaired. Last January he began to complain of hyperesthesia, numbness and loss of power in the little and ring fingers. The left wrist is somewhat restricted in motion: flexion 30 degrees, extension 20 degrees, only a slight amount of lateral mobility. Little and ring fingers held in semiflexion; unable to fully extend them voluntarily. Neurological examination revealed presence of an ulnar neuritis. Operation advised. Roentgenograms on February 14, 1926, showed osteoarthritic changes, and the appearance of an old fracture of the extreme tip of the olecranon process.

Operation, February 10, 1927: Incision over ulnar nerve. Considerable bleeding due to congested tissues. Nerve found bound down with dense adhesions. These were incised, the nerve was removed from its normal situation behind the internal condyle and surrounded by a layer of fat forming a tubular canal. The nerve was then returned to its former position. February 11, 1927, patient "feels life" in both fingers. February 19, 1927, discharged, moving fingers normally, and with sensation returned. The amount of motion in the elbow has increased, although no effort was made to overcome the bony obstruction. The only explanation for this increased motion is the relief of muscular spasm.

The literature contains about one hundred recorded cases of ulnar paralysis occurring from one to forty years following injury to the elbow. The description of the various contributors corresponds in many details. The primary cause is a fracture at the elbow, years prior to the onset of the paralysis. The site of injury

may be the internal condyle, the supracondylar region or, more often, the external condyle. The fractured area may not be accurately reduced, cubitus valgus resulting as a rule. This deformity causes impingement against the inner condyle, the ulnar groove becomes shallowed and the nerve may be displaced or stretched or irritated on flexion or extension of the elbow. This in time leads to partial or complete ulnar palsy.

OSTEOCHONDRITIS OF THE SPINE

HARRY FINKELSTEIN, M.D.

W. H., aged eight and a half years, was admitted to the Hospital for Joint Diseases October 30, 1925. History of a fall six weeks previous from a fence two feet high. No night cries, no loss of appetite or weight. Mother noticed that child walked peculiarly with the back stiff, and that there was a lump over the middle of the spine. Examination showed a slight kyphosis in the region of the eighth dorsal vertebra, some rigidity on flexion and hyperextension. No pain or tenderness, no abdominal masses, no paraplegia. Roentgen-ray examinations November 4, 1925 and February 11, 1926. The body of the eighth dorsal vertebra is compressed and represented by a small sclerosed fragment of bone. The intervertebral spaces above and below are increased in width. von Pirquet and Wassermann reactions negative. Treatment: The child was kept on a Bradford frame up to the time of the operation, which was on February 8, 1926. Bone graft was inserted into the spine from the sixth to the twelfth dorsal vertebrae. Roentgen-ray examination June 6, 1926, showed bone graft in place. April 23, 1926, patient out of bed wearing a plaster cast. May 23, 1926, case removed. July 1, 1926, referred to Country Branch at Far Rockaway. Motion is free in all directions, no pain or tenderness, no muscular spasm, general condition good.

This condition was first described by Calvé of Berck, France, in September, 1924.[1] His description, covering one case of his own and one exactly similar of Brackett of Boston, is as follows: The lesion attacks only one vertebra, whereas Pott's disease attacks at least two vertebrae. In striking contrast to tuberculosis, there is an absolutely intact condition of the discs above and below the diseased vertebra. The cartilage is thicker and there is a neoformation of this tissue. The transparent part above and below the lamellar osseous nucleus is at least one-third higher than normal. This is never seen in tuberculosis, which is markedly destructive of cartilage tissue. Greater opacity is to be observed, which indicates that bone density has increased. This condition on roentgen-ray examination and clinically resembles cases of coxa plana, Legg-Calvé's disease, infantile osteochondritis of the hip, and Koehler's disease. The result of treatment was excellent in both cases in a comparatively short time. Buchman[2] has added two cases, and refers to a case cited by Gallie; Buchman's description differs considerably from that of Calvé. His first case showed an involvement of eight dorsal vertebrae, while the second case showed an involvement of two vertebrae, the twelfth dorsal and the first lumbar. He explains the differences between his cases and those of Calvé by referring to other forms of osteochondritis, in which there are first irregular, moth-eaten, mottled porous appearances of the affected area, to be followed by the stage of regression when calcification processes set in to form the dense, sclerosed-appearing outlines.

[1] A localized affection of the spine suggesting osteochondritis of the vertebral body, with clinical aspects of Pott's disease. *J. Bone & Joint Surg.*, 1924, vii, 41–46.

OBLIQUE TRACTION FOR COMPENSATION IN SCOLIOSIS

LANTERN SLIDE DEMONSTRATION

DAVID R. TELSON, M.D.

(By invitation)

At the last meeting of the American Orthopedic Association in Atlanta, Dr. Arthur Steindler of Iowa read a paper on the Compensatory Treatment of Idiopathic Scoliosis. His feeling was that the curvature of scoliosis is healed in the same manner that any other spinal deformity is healed, namely by the elimination of motion in the deformed part. He felt that any method which attempted to attack major curvature by opening the segments of the spine by means of traction or exercise or plaster jackets was a method defeating its own purpose, and that the ultimate end-result was attained by either operative fusion or a natural fusion. He therefore stated that it would be wiser to allow the major curve to remain in the position one found it, and attempt to produce a compensatory curve

[2] Buchman, J. Osteochondritis of vertebral body. *Ibid.*, January, 1927, ix, 55–66.

either above or below, or both above and below, which would cause a state of equilibrium. I felt with Dr. Steindler that it was useless to attack the primary curve if a translatory shift of the shoulders was allowed to remain. If, however, as we see in this first case, there is a right dorsal curve with a shift of the shoulders a considerable distance to the right, any attempt to straighten out the curve would result in still further right translatory movement of the shoulders. While Dr. Steindler in his effort to secure compensation by means of the formation of a lumbar curve in the opposite direction of the translatory curve has used exercise, I have devised the method of oblique traction to attain the same result in what I feel is a more efficient manner. The result on this first case after three weeks of oblique traction is shown. (First lantern slide.) I have disregarded Dr. Steindler's dictum, and attempted to straighten the major curve, but the main accomplishment I feel has been formation of the secondary lumbar and cervical curves, allowing the shoulders to be placed directly over the pelvis. Notice also, however, that the major curve is considerably straightened as is shown by the added number of vertebrae pictured on roentgenogram of the same size. The next slide is one taken after six months, during which time the child has been wearing a plaster spica for six weeeks, and for the rest of the period has been in a special brace. The next slide demonstrates an oblique traction bed. One observes that there is a right dorsal curve with a right shift of the shoulders, also that the left hip was considerably higher than the right. I shall therefore fix the Sayre halter to the head of the bed and establishing a fulcrum at about the eleventh dorsal vertebra, by means of left lateral traction of 20 lbs. will swing both lower extremities to the extreme right side of the bed. I shall then add 15 lbs. traction on the left leg and 15 lbs. on the left side of the pelvis by means of a pelvic band. I shall add but 10 lbs. on the right leg and 10 lbs. on the right side of the pelvis, thus causing both a swing of the pelvis to the right with the fulcrum in the lower dorsal region and a leveling up of the two anterosuperior spines by means of adjustment of the lumbosacral junction. The child was kept in the traction bed for a period of approximately three weeks or until no increase in correction was obtained. I then applied a plaster of Paris spica with the child in Sayre suspension. In doing this, the right buttock was jacked up and the left thigh was included in the spica. In the future I shall apply this jacket by means of the Hibbs' traction frame, which I think is more effective than the Sayre suspension. The full correction of the shift of the shoulders is of course maintained while the spica jacket is being applied. At the end of six weeks, a special quadrilateral brace with thigh extension is ready and is substituted for the spica, and exercises are begun.

While the obliteration of the lateral shift of the shoulders should not be the only consideration in the treatment by any means, it is a major factor that has been very much overlooked in the treatment of this most baffling of deformities. Any treatment that does not include this correction will result in a straighter but a more oblique leaning tower of Pisa, and an invitation to further deformity will constantly exist.

EDITORIALS

SUTURE OF DIVIDED NERVES OF THE HAND

ONE of the most important contributions to surgery during recent months, it seems to us, is the paper on "Surgery of the Nerves of the Hand" by Sterling Bunnell of San Francisco, which was presented before the last Clinical Congress of the American College of Surgeons and appeared in *Surgery, Gynecology and Obstetrics*, February, 1927. Certainly, it is a very valuable, practical and original contribution to the reconstructive surgery of the hand and from one who had already greatly advanced that particular sphere of endeavor.

Nerves in the hand and fingers are sometimes divided surgically by incisions made for the relief of infections. Still more often they are cut by glass, knives or machinery. Injury to a small motor nerve in the hand, or anesthesia in a finger, especially of the thumb, index or middle finger, constitutes a real disability, especially to the artisan who works with small tools. And yet, probably because these nerves are so small, surgeons generally have made no effort to repair them. They probably underestimated the sacrifice of function, and assumed that suture of so minute a structure would not yield results commensurate with the difficulty of the task.

It is quite startling, therefore, to learn from Bunnell that "Of all nerve sutures throughout the body those that are the most uniformly, promptly and completely successful are of the hands and fingers." He says "After repairing one hundred and five nerves of the hand and fingers, largely in the course of operations on the tendons, the fact has been impressed upon me that if the ends of these nerves are accurately approximated, very good regeneration always follows. Although it is risky to use the word 'always' in surgery, in this instance it seems fully justifiable." He attributes these uniformly good results to two factors: first, that the nerves are no longer mixed but are purely motor or purely sensory; second, that the regenerative power of the nerves increases as the periphery is approached.

In six of his cases with defects in nerves of the hand too extensive to approximate the ends, Bunnell inserted grafts (some of them six inches long) from the sural nerve and secured "in every case sensation to light touch and pin prick and even some degree of stereognosis in almost the usual time and degree as after a simple nerve suture." He found that after suture of a volar digital nerve sensation was restored as a rule at the rate of a finger segment a month.

For the suturing of digital nerves Bunnell uses a No. 16 straight Kirby needle and the finest of silk thread, or even a single strand untwisted therefrom. For each nerve two guide sutures and four others are inserted, all through the sheath only. This is delicate work, to be sure, but it is quite within the technical capabilities of most trained surgeons. Bunnell has opened to the profession a field of surgical effort hitherto quite neglected.—W. M. B.

FREDERICK WILLIAM PARHAM

DR. FREDERICK W. PARHAM, who died on May sixth, was born in New Orleans, March 20, 1856, the son of John Greenway Parham and Mary E. Blunt. He was a graduate of the Randolph Macon College of Virginia and received his medical education at the University of Louisiana, now Tulane University. He did postgradute work in Philadelphia and in European clinics, where he studied under Czerny, Bramann, Hahn, Ewald, and others. In 1877 he was admitted, by competitive examination, to the Charity Hospital, where he served as Interne for two years during which occurred the malignant epidemic of yellow fever of 1878. From that time until his death his interest in the Charity Hospital never faltered and whenever he felt it necessary he worked untiringly for the betterment of its administration.

Frederick W. Parham (1856–1927).

Dr. Parham was Assistant House Surgeon of the Charity Hospital from 1885 to 1887, and one of his brilliant accomplishments was the inauguration and execution of a system of antiseptic and aseptic methods, which practically eliminated the fearful mortality caused by puerperal fever in the maternity wards.

He recognized the great lessons of Pasteur and of Lister, and when the means were not available for carrying out the teachings of these men he installed in his ward at Charity Hospital his own sterilizer and carried out in the same wards aseptic operations. It was through these demonstrations that he convinced the staff of the value of such aseptic procedure. It is hard to realize today, that it ever required the efforts of great leaders to prove to the community the worth of such teachings.

Other pioneer work of this great surgeon was in chest surgery. He was one of the first in this country to attempt extensive

work in malignant growths of the thoracic wall.

Dr. Parham was very active in organized medicine, having been President of the Southern Surgical and Gynecological Association, Vice President of the American Surgical Association, President of the Louisana State Medical Association, and President of the Orleans Parish Medical Society. One recent achievement of his was the organization of the Visiting Staff of the Charity Hospital of Louisiana, which he accomplished almost single-handed. He served as President of the staff for one year. He was a Fellow of the International Surgical Society, of the American Surgical Association, and of the American College of Surgeons, and was a Regent of the College from 1920 to 1925. He was a Major in the Reserve Corps of the United States Army and served as Chairman of the Medical Advisors of the Draft Board during the World War. Up to the time of his death he was Chief of one of the two surgical divisions of Touro Infirmary and Consulting Surgeon on the Staff of Charity Hospital. Dr. Parham was Dean of the first school for training nurses established in New Orleans.

Dr. Parham contributed many original essays, observations and devices which have enriched surgical literature and won for him international reputation. Among many notable contributions may be mentioned articles on "Resection of the Thoracic Wall for Tumor," "Vesico-Intestinal Fistulae," "Operations for Inaccessible Vesico-Vaginal Fistulae," "Treatment of Hypospadias," "Head Injuries Marked by Intracranial Tension," "Some Practical Problems in Intestinal Obstruction." He is internationally known for his original work in the surgery of bones, one of his latest contributions to this field being the Parham and Martin band devised for the treatment of oblique fractures of bone.

As Professor of General and Abdominal Surgery in the Post-graduate School of Tulane University he was a recognized authority on surgery. It was to this University that he devoted much time and thought having served as a member of the Board of Administrators from 1906 to 1914 and from 1925 until his death. His many years of service as Chairman of the Medical Advisory Committee of the Board stand preeminently as a model of conscientious and intelligent devotion to the highest interests of the School of Medicine and to the University. During his tenure of office many of the great reforms which have characterized the history of the School of Medicine in later years were first effected.

Recognizing his "services and achievements as a great and learned surgeon, as a medical leader, educator, administrator and public-spirited and self-sacrificing citizen, and more particularly the example set by his personal character, his absolute honesty, his conscientiousness in the discharge of his professional and public duties, his moral courage and his unapproachable integrity," Tulane University of Louisiana conferred upon him the degree of Doctor of Laws in June, 1925.

He loved science, as in science could be found the relief of human suffering, and he directed his best efforts to the study of methods for its alleviation. In reviewing his life one is reminded of one of his addresses in which the following lines occur: "For love is the thing that makes you care for the fate of this great round world. Everything that exalts life, makes possible unselfish devotion, inspires to great heroism and wins the utmost triumphs of art, has love as its root. 'He loved his fellow men' is the greatest enconium that one could wish at the end of a long life." He was jealous of the good name of his profession. When he detected anything that challenged that good name, or the integrity of a fellow physician, he would combat it with boldness and with a vigor that derived its force from an impregnable rectitude. The entire life of this great surgeon was "to strive, to seek, to find, and not to yield."

Muir Bradburn, New Orleans.

JOHN GOODRICH CLARK

JOHN G. CLARK was born in Wayne County, Indiana, June 4, 1867 and died May 4, 1927 of cerebral hemorrhage at the age of fifty-nine.

He was educated at Earlham College and Ohio Wesleyan University. In 1888 he entered the Medical Department of the University of Pennsylvania wherefrom he was graduated in 1891. Post-graduate study was continued at Johns Hopkins University and at the Universities of Leipzig and Prague.

At Johns Hopkins he first showed his great ability as a teacher and a clinician. While associated with Dr. Kelly he did his work on the circulation of the ovary and described the Clark position for lymphatic drainage in peritonitis.

In 1899 he accepted the professorship of gynecology at the University of Pennsylvania and occupied this chair until he resigned shortly before his death. Here he developed one of the outstanding gynecological clinics in America.

Dr. Clark was a fluent speaker, a keen thinker, a facile artist, a finished clay modeler—all of which gave him an unusual advantage in conveying the idea of the pathological picture to his auditors. He was among the first to employ the lantern slide, the blackboard and clay modeling in the teaching of his specialty, believing that visual demonstration was more lasting than the most oratorical description.

Clark was a developer of men. Many of his former assistants are occupying professorial positions in our great universities. His successor is a man whom he trained.

John Goodrich Clark (1867–1927).

During the thirty-five years of his active professional life he held appointments at Johns Hopkins, the University of Pennsylvania, the Woman's Bryn Mawr, Chestnut Hill, Germantown and St. Agnes' Hospitals.

He was a past President of the American Gynecological SocieCoty, and the ngress of Clinical Surgeons of North America, and Chairman of the Section on Obstetrics and Diseases of Women of the American Medical Association.

He was a man of charming personality and sterling character, and a delightful companion whose conversation was rife with illustrative anecdote. His prolific writings were always tempered with conservatism and carried weight wherever they were read. Probably no man in America has done more for the development of gynecological diagnosis than John G. Clark; and in his death we have sustained a very great loss.

John Osborn Polak.

NEW YORK AND NEW ENGLAND ASSOCIATION OF RAILWAY SURGEONS

THE thirty-seventh annual meeting of the New York and New England Association of Railway Surgeons will be held at the Hotel Pennsylvania, New York, October 21 and 22, 1927. The first day will be devoted to clinics and the second to papers and their discussions. These will be published in the Journal.

Subscribers to The American Journal of Surgery *visiting New York City are invited to make the office of the publishers (Paul B. Hoeber, Inc., 76 Fifth Avenue, New York) their headquarters. Mail, packages or bundles may be addressed in our care. Hotel reservations will gladly be made for those advising us in advance; kindly notify us in detail as to requirements and prices. List of operations in New York hospitals on file in our office daily.*

BOOK REVIEWS

FRAKTUREN UND LUXATIONEN. Ein Kurzgefasstes Lehrbuch für Ärzte und Studierende. By Dr. K. H. Bauer, Prof. für Chirurgie, Univ-Göttingen. 8vo. Paper. Pp. 236; 237 illus. Berl. Julius Springer, 1927.

This is a very compact, well-written and well-illustrated volume on the treatment of fractures and dislocations. The author has the faculty of presenting the subject in a terse, clear manner which makes the book interesting reading. However, there is nothing in the volume to make it of especial value to the American medical public, with its wealth of comprehensive works on this subject. The present volume is intended primarily for students but may quite easily be used as a ready reference work for those more conversant with the subject.

LA PRATIQUE CHIRURGICALE ILLUSTRÉE. By Victor Pauchet. Pt. 10. 8vo. Paper. 50 Fr. Pp. 250; 235 figs. Par. Gaston Doin & Cie., 1927.

The tenth part of Pauchet's "Practical Surgery Illustrated" discusses and depicts the treatment of lingual goiter, hydatid cysts and abscesses of the liver, lesions of the internal meniscus of the knee, cancer of the rectum, etc. As in the earlier volumes, the amount of text is reduced to a necessary minimum and the main emphasis is laid on the careful depiction of the various steps in the different operations by excellent drawings. Indeed, the schematic illustrations and the drawings are so well presented that the text can be almost ignored without in the least detracting from the value of the work. In the very brief text, the author proposes and answers a number of detailed questions that may arise in the mind of the surgeon both in the diagnosis and in the operative technique. Written by an essentially practical surgeon and intended primarily as a handbook of practical surgery, there is but little of theoretical discussion or of bibliographical reference. The work is a description of the technique employed by a great and experienced surgeon and as such is entitled to respectful inclusion among the works of the great surgeons of the world.

URINARY SURGERY. A Handbook for the General Practitioner. By William Knox Irwin, M.D., F.R.C.S. (Eng.); Surgeon to Out-Patients, St. Paul's Hospital for Genito-Urinary Diseases. Ed. 2. 16mo. $4. Pp. 271. N. Y. William Wood & Co., 1927.

The present, second edition, of Irwin's volume on urinary surgery has been enlarged by the addition of four chapters. The first two chapters deal with the anatomical configuration of the urinary tract and the methods of examination of the patient complaining of urological symptoms The following seven chapters are devoted to a discussion of the chief symptoms for the relief of which the patient seeks medical advice. In the last four chapters, the author gives a very sketchy outline of the surgical procedures recommended in the treatment of the different urological conditions. The volume makes no pretense at being a textbook on the subject. It serves in an admirable manner as a handbook for the general practitioner—the purpose for which its author prepared it. The volume makes solid but very clear and interesting reading.

LEHRBUCH DER PHYSIOLOGIE. By Prof. Dr. Emil Abderhalden, Halle. Pt. 4. Die Motorische System. 8vo. Pp. 648.; 211 illus., 1 col. pl. Berl. Urban & Schwarzenberg, 1927.

This constitutes the fourth and concluding part of Abderhalden's great work. Taken together with his monumental work on physiological chemistry, it forms a tremendously learned and stimulating introduction to the study of physiology. Undertaken and presented in the form of a series of lectures for the student of physiology, it may well serve as a guide for the research worker in this field. In the wealth of its bibliographical references, in its erudition and in the inspired style of its presentation, the work is worthy of lasting consideration. The present volume is devoted to a discussion of the motor system and its closely allied system, the central nervous system. It discusses not the nervous nor the muscular system but rather the neuromuscular system, the functional unit with the pathology of which practically every physician must at one time or another

cope. The volume is illustrated with a great number of well-chosen drawings and diagrams.

Exploration Clinique et Diagnostic Chirurgicall. By Félix Lejars, Prof. de Clinique Chirurgicale à la Faculté de Médecine de Paris; Ed. 2. 8vo. Cloth. 120 Fr. Pp. 911; 1094 photos and orig. draw. Par. Masson et Cie, 1927.

In this volume, which appears in its second edition in four years, Lejars has attempted to present to the medical public a textbook on surgical diagnosis which shall train the physician in the clinical methods of approach to a given surgical problem. Preeminently a clinician, the author's main interest has been devoted to the discussion of clinical methods. While admitting the great value of the laboratory diagnostic methods, Lejars insists that the physician should have been so trained that put in a situation where these laboratory aids are not available, he will still be in a position to make an intelligent survey of the surgical condition.

With this idea in mind, the author has set himself two questions: What must be thought of, and how must the examination be undertaken? For the purpose of better discussing these problems the subject matter has been topically divided. Thus there are chapters devoted to a consideration of the injuries and diseases of the head, the neck, the face, the abdomen, the extremities, etc. Under each of these divisions, the author conducts the description as if a patient were present. The appearance of the patient, the proper method of approach and the various clinical diagnostic procedures are treated in detail.

The volume is replete with excellent illustrations showing the exact method of performing the various tests and the results to be expected. The text is simple and interesting. The present edition differs from the first mainly in the number of illustrations.

Die Chirurgie. Eine zusammenfassende Darstellung der allgemein und der speziellen Chirurgie. Ed. by Prof. Dr. M. Kirschner and Prof. Dr. O. Nordmann. Pt. 15. Die Chirurgie der Milz. Die Chirurgie der sog. Blutkrankheiten. By Dr. A. Weinert, Magdeburg 8vo. Pp.23 8; 86 illus., 2 col. pl. Berl. Urban & Schwarzenberg, 1927.

The fifteenth part of the system of surgery edited by Nordmann and Kirschner is devoted to a discussion of the diseases of the spleen and the closely allied diseases of the blood. On this very complicated and as yet imperfectly understood subject, the author sheds a great deal of light both by the conciseness of his discussions and by the clarity of his classifications. The physiology of the spleen, the various clinical and pathological pictures presented in splenic disease as well as the operative steps to be employed in the treatment of these different conditions are described in an altogether satisfying manner. The whole problem of diseases of the blood is necessarily bound up from both a diagnostic and therapeutic viewpoint with the diseases of the spleen and is appropriately considered a part of the discussion of the spleen.

The whole volume is presented in the same delightful reading style that has characterized the earlier parts of this excellent system of surgery and with a wealth of colored and halftone illustrations such as have made German publications the envy of publishers the world over.

Gynecological Diagnosis and Pathology. By A. H. F. Barbour, M.D., LL.D., F.R.C.P., Formerly Lecturer on Gynecology in the University of Edinburgh and Gynecologist to the Edinburgh Royal Inf.; and B. P. Watson, M.D., F.R.C.S. (Edin.), F.A.C.S., Professor of Obstetrics and Gynecology in Columbia University. Ed. 3, 8vo.; Cloth. $4. Pp. 223; 8 col. pl., 201 figs. N. Y. William Wood & Co., 1927.

This small manual has a greater interest for American readers now that one of its authors, Watson, has come from Edinburgh to the chair of gynecology and obstetrics in Columbia University College of Physicians and Surgeons. In this third edition revision has chiefly been in the sections dealing with uterine displacements and inflammations.

PROGRESS IN SURGERY

Selections from Recent Literature

CUSHING, HARVEY. Experiences with orbito-ethmoidal osteomata having intracranial complications. With the report of four cases. *Surg., Gynec. & Obst.*, June, 1927, xliv, 721.

In his inaugural presidential address before the American Surgical Association Cushing gives a critical report of four cases of orbito-ethmoidal osteomata, all in men, producing bizarre symptoms and severe cerebral lesions (pneumatocele, mucocele). In the first case the removal of the bony growth resulted in death from meningitis by infection through the opening left into the nasal tract. In the second case death also resulted from meningitis, attributed by Cushing to his failure to attack the growth. In the other two cases the tumor was successfully removed by transfrontal osteoplastic approach, as in the first case, and cerebrospinal rhinorrhea was prevented by laying over the opening left into the ethmoid cells a "stamp" of fascia taken from the leg—a procedure Cushing had quite similarly employed in a case of meningicoma invading the frontal sinus.

PIOT, E., and LEDOUX-LEBARD. Roentgen therapy in the treatment of medullary tumors. (La roentgenthérapie dans le traitement des tumeurs médullaires.) *Presse méd. Par.*, April 13, 1927, No. 30, p. 465.

The authors call attention to the value of the lipiodal injections in the diagnosis of intraspinal tumors. After operative interference roentgentherapy is of the greatest value whether it be in tumors which have been removed or in tumors which are inoperable either because of their position or because of their pathological structure. They report on four tumors in three of which the diagnosis was established roentgenologically. These included a perithelial sarcoma, a lymphosarcoma, a gliomatous tumor and a hemangioma. In the first three, cure followed operation and roentgentherapy. In the fourth case, operation was impossible because of the character of the tumor but roentgentherapy resulted in marked amelioration of the symptoms. The technique of applying deep roentgen-ray therapy in these cases is discussed.

COLEMAN, CLAUDE C., Richmond, Va. Treatment of spasmodic torticollis by intradural posterior root section and extracranial division of the spinal accessory. *Virginia M. Monthb.*, March, 1927, liii, 761.

Coleman reports a case operated upon by by him with good results after the following procedure:

With the patient placed on a cerebellar frame, a midline incision was made from just above the external occipital protuberance to the sixth cervical spine. A short horizontal incision above the superior curved line crossed the median incision. The laminae of the first, second and third vertebrae were removed and the posterior rim of the foramen magnum, along with an area of bone about two inches in diameter, mostly to the right side, was rongeured away. The dura was opened and a superficial examination made of the right cerebellopontine angle. Nothing abnormal was discovered. The posterior roots of the first, second, third and fourth nerves were divided on each side. The identification of the first right posterior root was not accurate. The second cervical nerve root required ligation before division, because of a vessel of considerable size which accompanied the nerve root. The spinal filaments of the accessory nerve were brought into view and a section made of some of the lower ones. The dura was carefully closed and a closure of the muscles and skin made in layers. Spasm of the posterior muscles did not return after the operation but there was some deviation of the chin to the left. During the following two weeks and before the spinal accessory was divided, it was possible to make careful observation as to the effects of posterior root division alone. The right accessory nerve was then resected under local anesthesia, just proximal to its entrance into the sternomastoid muscle.

SPIELBERG, WILLIAM, New York. Visualization of the Eustachian tube by the roentgen ray. Preliminary report. *Arch. Otolaryngol.*, April, 1927, v, 334.

By employing a proper technique, roentgenograms can be made of the Eustachian tube. The roentgenograms show that the Eustachian tube assumes the course of an inverted S, making two curves as it leaves

the tympanic cavity arching downward and forward across the space between the anterior canal wall of the bony external auditory meatus and the condyle of the mandible. Crossing the latter, it continues in its course downward for from 15 to 20 mm. and describes another slight curve downward and forward, terminating as the pharyngeal end in the pharynx.

Length of the tube is from 30 to 33 mm. from the mouth to the tympanic end. Its length can be increased by passing a metal filament into the tube, thus putting the membranous portion on a stretch.

The tympanic orifice of the Eustachian tube is from 2 to 2.5 cm. higher than the pharyngeal end, but in some cases has been found to be only 1 cm. higher. The osseous portion, as well as the tympanic opening, appears as a prolongation of the anterosuperior portion of the tympanic cavity. The superior wall of the tympanic cavity merges into the bony portion of the tube.

Bony and membranous portions can easily be differentiated from one another and their course visualized. The bony portion forms one third and the membranocartilaginous portion two thirds of the entire length of the Eustachian tube. The width of the bony portion was found to vary between 2 and 3 mm., the width of the membranous portion between 1 and 1.5 mm. Strictures or stenoses can be distinctly visualized and located.

Iodized oil instilled into the tube was retained only a few minutes. Both the act of swallowing and the action of the ciliae cause the rapid evacuation of the foreign matter injected into the tube. This, however, was found not to be the case in patients with dilated tubes or in those in whom atrophic changes had taken place in the lining epithelium. In one such case the roentgenogram showed the presence of iodized oil one week after the initial injection.

Van Meter, E. R., St. Louis. Intranasal radium therapy in malignant and benign tumors. With case reports. *Arch. Otolaryngol.*, March, 1927, v, 225.

From observations on ten cases, and from the observations of other writers, Van Meter draws the following conclusions:

1. Malignancies occurring in the nose or nasopharynx are far more frequent than even the most conservative believe.

2. More careful study by the rhinologist of this type of case, especially of the nasopharyngeal space, should be made.

3. In certain malignancies, when diagnosis is made early, radium offers greater possibilities as a therapeutic agent than any other known remedy.

4. In persistent, recurrent cases of nasal polypi, combined surgical and radium treatment is to be preferred, and a certain number of these patients recover under this treatment.

5. Larger doses of radium should be used, and the radium should be administered in one dose rather than in divided doses.

6. Radium should not be used until four weeks after operation.

Roy, J. N., Montreal. The method of choice for the correction of saddle nose. *Arch. Otolarynogol.*, March, 1927, v, 258.

Roy believes the ideal method for correction of depressed nasal deformities consists in making an internal incision and, having prepared a tunnel, inserting cartilage of the first floating rib. When the graft is placed in position, the application of two little bands of adhesive tape transversally to the nasal bones fixes it, and consequently offers better conditions for adhesion with the surrounding tissues. Carried out in this manner, the operation is more likely to be successful than by any other method.

Harris, Thomas J., New York. Is radium a cure for cancer of the larynx? An inquiry based on a study of the end-results. *Arch. Otolaryngol.*, April, 1927, v, 301.

Gradually, as not merely failures resulted, but as suffering apparently was increased under the treatment and death hastened, the conclusion was reached that radium in the treatment of malignant disease of the larynx up to date has been harmful.

Harris has ceased to use radium unless for some exceptional reason. If the case has reached the stage in which operation is ruled out, such measures are used as will make the patient as comfortable as possible without adding to his suffering, by increasing the obstruction in the larynx, as radium often has seemed to do. For such obstruction a simple tracheotomy has been seen to give the desired relief in more than one case.

If operation is indicated, radium is not substituted. In case operation is refused, radium

would not be advised until other measures have been carefully considered.

Stiles, Porter, Birmingham, Ala. Vegetal bronchitis: observations on fifteen cases. *South. M. J.*, April, 1927, xx, 269.

The aspiration of vegetable substances, especially by children, produces a much more severe local and systemic reaction than is the case with metallic foreign bodies.

Vegetable foreign bodies are quite apt to remain movable in the trachea with the consequent danger of subglottic impaction and asphyxiation, while the likelihood of their swelling from moisture is an added menace.

The systematic enlightenment of parents and nurses, as to the danger of giving peanuts, watermelon and similar substances to young children, would materially reduce the number of these accidents.

Left untreated, these cases are almost invariably quickly fatal; if subjected to early bronchoscopy, the prognosis is distinctly favorable.

Bram, Israel, Philadelphia. Relationship of diseased tonsils to goiter. Observations based upon a series of 9864 goiter cases. *Med. J. & Rec.*, April 6, 1927, cxxv, 442.

Bram concludes:

1. In simple goiter it is doubtful whether diseased tonsils play an etiological rôle. Hence, tonsillectomy, without the administration of additional therapeutic measures, usually fails to cure the patient.

2. Hypertrophied tonsils without evidences of infection are frequently coincidental with simple goiter of the hypertrophic, colloid, and hyperplastic types during puberty and adolescence and if nonobstructive, may remain.

3. Diseased tonsils appear to play a minor rôle in the assumption of toxicity (hyperthyroidism) by a previously nontoxic goiter. Tonsillectomy in these cases may result in a degree of amelioration of toxicity but the goiter itself is unaffected.

4. In exophthalmic goiter diseased tonsils often play a contributory etiological rôle. The major factors are apparently the predisposing neuropathic make-up of the individual, superimposed upon which a psychic trauma appears to be the usual exciting cause of affection. Tonsillectomy in exophthalmic goiter with the expectation of curing the disease is usually disappointing; this procedure should be regarded as merely supplementary to more direct therapeutic measures.

5. Despite frequent disappointments as to results, diseased tonsils should be removed in all goiter cases. Care must be exercised in toxic adenoma and especially in exophthalmic goiter that tonsillectomy be performed at a time when the resultant reaction would appear to be negligible.

Jackson, Arnold S., Madison, Wis. Primary thyroidectomy for exophthalmic goiter. With a report of 120 cases. *Surg., Gynec., & Obst.*, March, 1927, xliv, 406–411.

The reduction in the surgical mortality in exophthalmic goiter is due to several factors: (1) Patients are being brought to the surgeon in the early stages of the disease; (2) physicians are now recognizing hyperthyroidism in its incipiency; (3) the perfection of surgical teamwork has reduced the time required for operation; (4) the use of the morphin-scopolamine-novocaine as an anesthetic has eliminated certain operative complications; (5) the basal metabolic unit has enabled the physician and surgeon better to judge the patient's condition, and (6) the discovery by Plummer of the efficacy of iodine has been a great aid to surgery.

Jackson abandoned the ligation-operation and stage-operation in 1924, and this series of one hundred and twenty consecutive cases, in which only primary thyroidectomy was performed, is presented to show the benefit to be derived from iodine. At first it was used in only small amounts; then the dosage was increased and the period of pre-operative preparation shortened. Attention was called to the remarkable change in the pathologic picture of the gland; hyperplasia was replaced by colloid and the gland tended to revert to normal.

The period of preparation in this series was usually one week; the longest period was two weeks. When a patient showed marked loss in weight and strength, or cardiac complications had occurred, he was sent to the hospital for preparation. About one-third of this series were in this group. When these conditions are severe, it may be necessary to delay operation longer, but it should not be delayed too long, since a tolerance to iodine may develop and operation is then performed with considerable risk. Patients were encouraged to be up several hours a day except in case of cardiac decompensation. The diet was increased to the equivalent of 4500 calories a day; luminal was

used as a sedative. The average dose of iodine (Lugol's solution) is forty drops daily in four doses, well diluted. The use of ice bags has been discontinued except during a crisis with fever; at this time the dosage of iodine is increased.

Clinical improvement of the patient was noted within forty-eight hours. The frightened, anxious, staring expression had disappeared; the restless, purposeless movements were replaced by a quiet demeanor; the pulse was slowed, and the patient no longer complained of a rapid, pounding heart; the pulse pressure decreased and the thrill and bruit often disappeared.

In this series there was an average reduction in the basal metabolic rate of +16; the average rate was +46 before treatment and +30 after treatment. In only five cases was operation performed when the metabolic rate was more than +50.

In every patient with the exception of a nine-year-old boy only local anesthesia was used. In order to insure the best prognosis as much of the gland as possible should be removed, only a small strip being preserved on the posterior border sufficient to protect the recurrent laryngeal nerves and the parathyroids. One lobe was always resected, the vessels ligated and the field cleared before proceeding to the opposite lobe. Iodine was given postoperatively by mouth and by rectum, one hundred drops or more in twenty-four hours. Water and morphine were given freely. In one case postoperative pneumonia occurred. Postoperative infection and permanent injury to the nerve did not occur. One patient died because iodine was not administered until ten hours after operation.

The time that has elapsed since operation is too short to state that permanent cures have resulted, but 92 per cent of the patients consider themselves cured or greatly improved. Practically every patient is performing his normal duties. There has been an average gain in weight of twenty-one pounds. The pulse rate in most cases has dropped from 120 to 79.

Baldridge, Clarence W., and Peterson, Frank R., Iowa City. Splenic enlargement in hyperthyroidism. *J. Am. M. Ass.*, May 28, 1927, lxxxviii, 1701.

Splenic enlargement in hyperthyroidism is more frequent than one would be led to believe from its lack of mention in the literature. One hundred and forty-four patients with exophthalmic goiter were studied by Baldridge and Peterson, within six months. Of these, forty-four have had palpable spleens. From none of the patients with enlarged spleens were the authors able to obtain a history of malaria or other disease usually associated with splenic enlargement. During the same period, eighty-one cases of adenomatous goiter were observed. Hyperthyroidism was present in forty-two of the eighty-one cases, but in no instances were there the typical manifestations of exophthalmic goiter. Only three patients of this group had palpable spleens. The cause for enlargement of the spleen in exophthalmic goiter is not clear. It does not seem justifiable to account for the splenic enlargement in hyperthyroidism as being due to any specific antagonistic action between the spleen and the thyroid gland. The authors are not inclined to attribute the splenic enlargement in hyperthyroidism to an increase in the destruction of red blood cells. Two possible explanations for the splenomegalia are apparent from the study of these cases: First, that the splenic enlargement is passive and is secondary to cardiac failure or to cirrhosis of the liver, either toxic or cardiac; and, second, that the enlargement of the spleen is an active process with lymphoid hyperplasia and is only a part of a generalized hyperplasia of lymphoid tissue. Of these the latter seems the more plausible. The patients, as a group, have not been followed long enough to warrant a positive statement in regard to decrease in size of spleen following operation. In the four fatal cases in which necropsy was obtained, the spleen showed marked lymphoid hyperplasia, as did all the other fixed lymphatic tissues. In this series of cases, palpable spleens were found almost exclusively in those patients presenting the clinical features of exophthalmic goiter.

Sante, L. R., St. Louis. Massive (atelectatic) collapse of the lung, with especial reference to treatment. Report of an additional case. *J. Am. M. Ass.*, May 14, 1927, lxxxviii, 1539.

The treatment recommended consists in rolling the patient back and forth on the uninvolved side. No other therapeutic agent is necessary. This simple procedure has, in all instances in which it has been used, proved successful in promptly reestablishing aeration of the lung.

Roch, M., and Frommel, E., Geneva. Local anesthesia in the treatment of visceral and serous pains. (Anesthésie locale sous-cutanée dans le traitement de douleurs d'origines viscérales et séreuses.) *Presse méd. Par.*, March 26, 1927, No. 25, p. 385.

The authors report on eighteen cases of angina pectoris, acute pericarditis, pulmonary gangrene, pleurisy, cholecystitis, etc., treated by the method suggested by Lemaire several years ago. This consists in subcutaneous local infiltration of 10 c.c. of a 0.5 per cent solution of novocaine over the area of referred visceral pain. The authors incline to the opinion expressed by Mackenzie that by this procedure they are able to interrupt the efferent pathway of a viscerosensory reflex and thus afford relief to the patient. The only inconvenience in the method is that if applied to conditions that may be surgical in character, there is danger of masking symptoms.—Henry Milch.

Koennecke, W., Oldenburg. Adhesive pericarditis and its surgical treatment (Schweilige Pericarditis und ihre chirurgische Behandlung). *München med. Wchnschr.*, April 22, 1927, lxxiv, 675.

Adhesive pericarditis is characterized by no definite clinical picture. The history of a previous acute pericarditis, the presence of an enlargement of the liver and a marked ascites and the fluoroscopic appearances of an abnormally quiet cardiac pulsation make the diagnosis. Surgically, two types may be differentiated: that in which the pericardium is adherent to the anterior chest wall; and that in which the pericardium is concentrically thickened and impairs heart action. In the former instance simple removal of the third to sixth ribs anteriorly to allow expansion of the heart is sufficient to insure amelioration of symptoms. In the second type, simple removal of the ribs is insufficient and the heart must, in addition, be freed of its impeding fibrous envelope. To facilitate removal, a portion of the left sternal margin must be removed and the fibrous envelope incised over the left ventricle. Thereupon the rest of the membrane is removed by the use of the finger, care being taken not to puncture the heart wall. It is apparently unnecessary to carry dissection beyond the ventricles. The wound is completely closed leaving only a few strands of catgut to act as a drain. Unless the liver has been irreparably damaged, relief should be prompt.

Loevenhardt, A. S., and Crandall, L. A., Madison, Wis. Calcium carbonate in the treatment of gastric hyperacidity syndrome and in gastric and duodenal ulcer. *J. Am. M. Ass.*, May 14, 1927, lxxxviii, 1557.

Calcium carbonate used without any other inorganic salt is the best antacid for use in the gastric hyperacidity syndrome, and in gastric duodenal ulcer, for the following reasons:

1. It is exceedingly bland.
2. It is insoluble, being only a potential alkali, i.e., an alkali in the presence of acids stronger than carbon dioxide.
3. It is without effect on the bowel.
4. It causes the minimum disturbance of the acid-base equilibrium of the body and of the mineral metabolism.

It is practically foolproof in the hands of the patient. It is best used in the form of compressed tablets which disintegrate readily and which contain a very small amount of a carminative, such as oil of cinnamon.

Sebéning, W., Frankfurt. Late results after acute necrosis of the pancreas. (Folgezustände nach akuter Pankreasnekrose). *Med. Klinik*, April 15, 1927, xxiii, 551.

The author has been able to follow over a period varying from one-half to seventeen years, twenty-one patients who survived after operation for acute necrosis of the pancreas. He comes to the conclusion that:

1. Transitory disturbances of carbohydrate metabolism are frequent within the first one-half year and even after the lapse of many years diabetes and even death from diabetic coma may supervene;
2. Disturbances arising from the lack of the external secretions of the pancreas are rare and can be easily controlled by the administration of pancreatic extracts;
3. Recurrences are extremely rare;
4. The formation of pancreatic cysts is but very occasionally seen;
5. Fistulas usually heal spontaneously;
6. Adhesions seldom cause any trouble;
7. Incisional hernias are relatively frequent.

Saunders, H. P., Chicago. Surgical treatment of congenital umbilical hernia. *Ill. Med. J.*, March, 1927, li, 204.

The cord of every baby should be carefully examined for hernia immediately after delivery.

The prognosis of large congenital umbilical

hernia is grave, but better in cases treated surgically than in those treated conservatively.

The quickest and least traumatic procedure consists of ligating the umbilical vessels securely as close to the abdominal walls as possible. The sac is then opened prolonging the incision up and down the abdomen above and below the umbilicus just as far as is necessary in order to replace the contents without having to squeeze and handle them too much. As soon as they are all replaced, the sac is removed, transfixed and ligated, thus closing the peritoneum. The other layers are then closed by through and through mattress sutures of silkworm gut including all the layers and closing the entire incision in this manner.

Mayo, Charles H., and Dixon, Claude F., Rochester, Minn. Retroperitoneal lipoma: A report of three cases. *Minn. Med.*, May, 1927, x, 272.

The symptoms of retroperitoneal lipoma are variable. Of twelve cases reported by Masson and Horgan six patients first noticed a sensation of increased pressure in the abdomen, six complained of slight abdominal pain and two of pain in the back. In only one case was the pain severe. Six complained of food distress and occasionally vomited. Five had quite obstinate constipation and six had lost weight. In cases in which the lipoma was degenerating the symptoms were acute, with fever, localized tenderness and an increase in leucocytes.

About 79 per cent of the tumors were in the abdominal cavity and 21 per cent in the pelvis. They usually arise from the pararenal fat, but may arise from the renal capsule, the mesentery, the pararectal or retrorectal fat. They occur quite equally on both sides of the abdomen, possibly more often on the left than right.

The ultimate prognosis is usually grave. In von Wahlendorf's series the operative mortality was 25 per cent; in Masson and Horgan's series, 16 per cent. Recurrence is not uncommon and often with recurrence there is sarcomatous change.

Retroperitoneal lipomas are more common than has been supposed, and exploration should be carried out in all cases of abdominal tumor, particularly if the enlargement has been slow and no organic disturbance can be elicited. Retroperitoneal lipoma before removal often resembles sarcoma, grossly. A specimen should always be examined microscopically and if no malignant change is found the tumor is usually removed.

Mayo removed the tumors through a right rectus incision 2.5 cm. from the umbilicus. This affords good exposure for exploration and can be extended as desired. It is apparently much better than the posterior incision advised by Krogius, which would be feasible for exploration of small tumors lying near the kidney. In these three cases the tumor spread within the mesentery of the transverse colon. Their origin was therefore on the left side of the spine. In two of the cases the omentum was taken up in the great spread of the tumor.

Faure, J. L., Paris. The Mikulicz tampon in intestinal surgery. (Le Mikulicz en chirurgie intestinale.) *Presse méd.*, March 30, 1927, No. 26, p. 401.

Faure makes a plea for the employment of the Mikulicz tampon which has practically fallen into disuse. He shows that until some vaccine is discovered which will prevent the development of postoperative infections of the peritoneal cavity, the Mikulicz tampon is practically the only certain means of preventing death in a number of the serious intra-abdominal operations. Its use is especially desirable in cases of carcinoma of the uterus, in resections of the colon, and in purulent appendicitis. He points out that in a series of 36 cases of operations on the colon, the Mikulicz tampon was not used in 20 cases with an operative mortality of 40 per cent. In 16 cases in which the Mikulicz tampon was used, the operative mortality was only 13.3 per cent although these cases were more serious than those in the other series. Of 9 cases of abdominoperineal resection of the rectum for cancer, only one died. Of 15 cases of purulent appendicitis, 9 with generalized peritonitis, operated upon by Roux-Berger using the Mikulicz tampon, there were no deaths and only one with weakness of the abdominal wall. In 13 similar cases with 5 generalized peritonitides in which the tampon was not used, 4 died, 3 had stercoral fistulas, 2 had purulent pleurisies, 2 eventrations and only 2 healed without any untoward incident.—Henry Milch.

Kilduffe, Robert A., Atlantic City. Concerning the Sgambati urine test in peritonitis. *J. Med. Soc. N. J.*, April, 1927, xxiv, 221.

In 1920, Sgambati described a urine reaction

which he believed to be applicable to the diagnosis of peritonitis. The test is applied as follows: To 6-8 c.c. albumin-free urine in a test-tube, 2 or 3 c.c. pure nitric acid are added without mixing. If the test is positive (first phase) a bluish-gray color appears at the point of contact of the urine and acid. The second phase of the reaction is elicited by adding 2 or 3 c.c. chloroform, when, in positive cases, the color becomes ruby red and diffuses throughout the tube on standing.

Kilduffe believes, with Marcialis, that the first phase of the reaction is probably influenced by the indican content of the urine and is of no particular significance. While the reaction does not appear to occur promiscuously, neither is it uniformly encountered in peritonitis, nor is it diagnostic of nor specific for this disease. It does not appear to be of sufficient value to warrant its addition to the usual methods of laboratory study employed in this condition.

Kendig, Edwin L., Victoria, Va. Conservation of the function of the cervix in the treatment of chronic endocervicitis. *Virginia M. Monthly*, May, 1927, liv, 94.

In selecting a method of removing the infected areas of a chronic endocervicitis consideration should be given to conservation of the function of the cervix. Cautery striping and enucleation seem to offer the best methods of conserving this function. Of the two, cautery striping, when indicated, is the better method.

Cotte, G., and Bertrand, P., Lyons. Implantation of tube into the uterus (L'implantation tubo-uterine). *Gynéc. et Obstét.*, 1927, xv, No. 3, 182.

The authors call attention to the fact that in sterility of tubal origin, the site of obstruction is frequently at the ampulla. In order to overcome this obstruction, they advise resection of the ampullary end of the tube and its reimplantation into the fundus of the uterus. The technique is similar to that used in reimplanting ureters into the bladder. The end of the divided tube is threaded and the thread is simply passed by a needle into the fundus of the uterus and held in place by several peritoneal sutures. The authors report fifteen cases in which this operation was performed and noted in the literature either by themselves or by others.—Henry Milch.

Villard, E., and Labry, R., Lyons. Retrograde subserous salpingectomy. (De la salpingectomie rétrograde sous-séreuse.) *Gynéc. et Obstét.*, xv, No. 4, 259.

The authors call attention to the advisability of conserving ovarian and uterine function in the presence of adnexal infections requiring ablation of the tubes. In such cases, they suggest subserous removal of the tubes in the manner described by them. Their method permits of complete reperitonealization of the stump, leaves the ovary with an adequate vascular supply and precludes the necessity of removal of the ovary. The ampullary end of the tube is resected and then by means of two parallel incisions along the mesosalpinx the tube is freed and removed without injuring the ovarian blood supply. The mesosalpinx is then sutured. This procedure is of value in cases of ectopic pregnancy, where the ovary must be kept in order to prevent the onset of artificial menopause and in cases where the massive adhesions make the liberation of the adnexa difficult.

Hermitte, J., and Dupont, R., Paris. Enervation of the ovary. (De l'enervation de l'ovaire.) *Gynéc. et Obst.*, 1927, xv, No. 35, 161.

The authors observe that the so-called sclerosing type of ovaritis associated with pain and frequently treated by partial resection is usually accompanied by interstitial fibrotic changes about the terminal sympathetic nerves. It is this involvement of the nerve fibers that causes the pain and it is the section of these sympathetic fibers in the various sympathectomy operations which has brought relief to the patient. The authors' study of the anatomy of the ovarian nerves shows that the best place to attempt treatment of these fibers is at the hilus, just as they enter the ovary. They suggest that through a small incision in the broad ligament, the ovarian vessels be exposed, isolated and ligated. This assures complete severance of the pain-carrying nerves. The operation is simple in technique.

Henry Milch.

Wolfe, Samuel A., Brooklyn, N. Y. Ovarian luteoma, with case report. *Am. J. Obst. & Gynec.*, May, 1927, xiii, 575.

The author describes in detail clinical history and gross and microscopic findings of a true ovarian luteoma. The cells are of the pale

type but granular, grow diffusely or in alveoli, and have not contact with capillaries. The tumors are gray-yellow on gross appearance.

Lutein tumors of the ovary have been erroneously interpreted as "ovarian hypernephromata." The yellow color of these tumors, the clear cells, and the intimate relation to capillary walls are insufficient criteria to show suprarenal cortex histogenesis. The normal corpus luteum in several of its developmental and regressive phases possesses gross and histologic features that mimic suprarenal cortex structures. Tumors of lutein origin retain some or all of these characters.

Rosenzweig, Maxwell, Brooklyn, N. Y. Syncytial endometritis and syncytioma. *Am. J. Obst. & Gynec.*, May, 1927, xiii, 563.

Two cases are presented of transitional lesions in the chorioma group: (a) Syncytial endometritis; (b) syncytioma. The lesions are essentially benign. The treatment of syncytial endometritis is conservative, curettage being the method of choice in the majority of cases. Without the recognition of the syncytial or transitional group the malignant tumors cannot be interpreted properly.

A review of the literature shows that there is not a general cognizance of these lesions and that many cases reported as typical malignant chorioepithelioma are really of these transitional types.

Judd, E. Starr, and Simon, Harold E., Rochester, Minn. Hemorrhagic cysts of the kidney. *Surg., Gynec. & Obst*, May, 1927, xliv, 601.

Simple hemorrhagic cysts of the kidney form a distinct group apart from the serous cysts and the hemorrhagic cysts occurring in conjunction with neoplasms. The etiology is obscure and none of the hypotheses proposed thus far are entirely satisfactory. The suggestion that the cysts may originally have been aneurysms is the most acceptable one and is the only one that is entirely consistent with clinical and pathological findings.

The cysts rarely occur and their symptoms are not characteristic. The diagnosis has rarely if ever been made pre-operatively, and even at operation it may be difficult to know that one is not dealing with a neoplasm.

Treatment is surgical, consisting in resection of the cyst when feasible, otherwise in nephrectomy.

Hinman, Frank, San Francisco. Pyelovenous backflow at the time of pyelography. *Surg., Gynec. & Obst.*, May, 1927, xliv, 592.

The interlobar veins pass up next to the wall of the calyces, and in some places are in almost direct contact with the mucosa of the calyces, large venous spaces being seen in close relation to the lumen of the calyces on microscopic section. These interlobar veins arch around the pyramids in these calycine fornices, and it would seem to be mainly at this point that a pyelovenous communication is first established.

Pyelovenous backflow frequently occurs at the time of pyelography and tubular backflow for a short distance into the papillary ducts also occurs. In the case of pyelovenous backflow, radiation into the cortex first appears as a cone or funnel deformity from the base of pyramids, and if back pressure is sufficient may later show the arching from filled anastomotic venous arches. Radiation into the cortex then appears along the interlobular veins, a picture that never occurs with tubular backflow in which there is a short brush-like radiation from the tip of the papilla into the medulla for a short distance. Such pyelovenous and papillary backflow when unrecognized may lead to errors in interpretation of pyelograms.

Blaustein, Nathan, New York. Cystography an invaluable aid and advanced method of diagnosis of tuberculosis of the genito-urinary system. Preliminary report of investigation. *J. Urol.*, May, 1927, xvii, 469.

Blaustein asserts that the least dangerous of all methods of diagnosing tuberculosis of the genitourinary tract is the simple procedure of making cystograms. In tuberculous lesions, whether affecting kidney, ureter or bladder singly or collectively, the cystogram will reveal a pathologic state of the bladder never so graphically demonstrated heretofore. The pathologic entity is so conclusive that it constitutes a diagnostic certainty. A cystogram demonstrates the splinting of the bladder wall on the affected side; and whether the lesion is in kidney, ureter or bladder the picture is the same. Musculature of the bladder wall on the affected side is in a high degree of spasm, is rigid and unyielding, and instead of the globular roundness seen in the normal bladder there is sharp flatness beginning at the dome

and ending at the base. Blaustein proposes the term "incline bladder" for this condition. He uses a 2 per cent or 2.5 per cent solution of sodium iodide instead of the 12.5 or 15 per cent strength commonly used for this work.

Ballenger, Edgar G., and Elder, Omar F., Atlanta, Ga. Post-operative cystitis. *South. M. J.*, April, 1927, xx, 321.

Concerning the cause or causes of the cystitis which follows operations, when the bladder has become overdistended and urethral catheterization is required, the general assumption seems to be that an infection has been carried by the catheter. Although this may at times be a factor, it is not the primary factor in the majority of instances. The actual cause of the cystitis more frequently is trauma in the form of small lacerations of the mucosa from sudden overdistention of the bladder. These minute injuries afford an entrance for organisms passing down from the kidneys or up through the urethra. When the distention of the bladder is gradual in onset, as in prostatic obstructions or tabes, the pavement epithelium grows as the residual urine increases and the minute lacerations do not develop as they apparently do in rapidly distended bladders. Danger of prompt or repeated catherizations is trivial compared with danger of injury to the bladder mucosa by overdistention. This view is strongly supported by the rarity of cystitis after operations when the bladder has not become overfilled and by the infrequency of cystitis from urethral instrumentation. Overdistention of the bladder always precedes this type of cystitis. The mucous membrane when damaged by overdistention or trauma from chemical agents becomes a less efficient barrier against infection, just as does the injured epidermis. Surgeons should leave a standing order after operations for careful observation of the patient's bladder in order that it may be emptied before harmful distention occurs. Furthermore, it may be of value, when catheterization becomes necessary, to inject a mild germicide into the bladder after it has been emptied to control or limit the infection if damage has been done to the mucosa by the overdistention.

Moore, Thomas D., Memphis. The diagnosis of bladder atony. *J. Tennessee M. A.*, Feb., 1927, xix, 286.

Diagnosis of bladder atony is important because of the evident tendency to ascribe the patient's symptoms to some obstructive condition, resulting in futile surgical interference. Two of the cases reported had been subjected to prostatectomy without relief, due to such erroneous diagnoses.

The outstanding features of the disease are five in number: (1) Marked urinary difficulty; (2) residual urine, usually a large amount; (3) the absence of any discoverable obstruction to the urinary stream; (4) poor detrusor tonus as noted by the slow dribbling from an inserted catheter or manometer reading, and (5) diminished sensory responses.

Three patients, two men and one woman, having atony of the bladder, were subjected to careful examination of the central nervous system, including study of the spinal fluid. In all of them the results were negative. Studies of the intravesical tension with a water manometer revealed a curve somewhat typical of the disease. Bladder sensory tests disclosed varying degrees of anesthesia for tactile, thermal, and pain stimuli. These findings favor the opinion that atony of the bladder is dependent upon some disturbance in the local nerve supply, probably a degenerative process involving the hypogastric plexus or interference with the reflex tract through the vesical center in the lumbar cord.

Turner, B. Weems, Houston, Texas. Syphilis of the urinary bladder with report of six cases. *South. M. J.*, April, 1927, xx, 289.

Primary and secondary syphilitic manifestations in the bladder are as a rule comparatively insignificant. They vary from a generalized reddening of the mucosa to a discrete, macular or petechial reddening which readily clears under treatment of the disease. Vesical gummata are among the rare syphilitic manifestations, and as a rule are probably not recognized unless ulceration with secondary infection and hemorrhage directs attention to the bladder.

The characteristic pathological finding of syphilis of the bladder in its tertiary manifestations is a true cystitis, with thickening of the entire wall of the bladder and resultant contracture and reduction in its capacity. The lesions more frequently appear at the base, usually some portion of the trigone, and it is believed that this predilection possibly arises from the location of the lymph glands and glandular tissue in that region. Given a lesion in the bladder, the differential diagnosis is to be

made between elusive ulcer, papillomata, carcinoma, tuberculosis and sarcoma. It is not possible to make an absolute diagnosis with cystoscope alone, but certain characteristics are fairly significant and warrant seeking other evidences. Among these are generalized thickened, reddened mucosa with macules distributed at the base, pearly, opalescent papules occurring as bullae adjacent to the ulcer or papillomata, with an absence of the typical elevation and infiltration seen in malignancy.

It seems that syphilis is not a factor in production of papillomata, although two of Turner's cases showed definite papillomata, with papillary vegetations coexisting with the bladder lesion. It is also quite evident that malignancy can be engrafted upon a syphilitic lesion of the bladder.

Tait, J. T., Melbourne. Prostatectomy and its after-results. *Med. J. Australia*, April 16, 1927, p. 571.

Of eighty patients admitted 82 per cent were operated upon in one stage and 18 per cent required the two-stage method. The two groups were distinguished by general clinical examination rather than by the renal function test.

The operative mortality for suprapubic prostatectomy in one stage was 4.6 per cent, the mortality for all cases being 8.75 per cent. In 85 per cent of one-stage operations for prostatic disease of innocent nature the late results were satisfactory, though 10 per cent of the patients had an attack of epididymitis after discharge from hospital. In the remaining 10 per cent there was persistent cystitis.

In 12 per cent of cases histological examination showed that malignant change was present in the prostate and of these patients only 50 per cent were well two years after operation. A relatively frequent sequel of two-stage prostatectomy was postoperative hernia, otherwise the late results were comparable to those of the operation in one stage.

Sénèque, J., Paris. Results of suprarenalectomy in spontaneous gangrene of the extremities. (Résultats de la surrenalectomie dans les gangrènes spontanées des membres). *Presse méd.*, April 9, 1927, No. 29, 454.

Sénèque reviews the literature on the treatment of gangrene and especially thromboangitis obliterans by means of excision of the left suprarenal gland. He quotes the statistics of Herzberg in 110 cases, of which 8 were Herzberg's. Of this series, 14 were reported to have been cured. In all but three, results are too recent to be of much value. It has been claimed that there is definite amelioration of the symptoms, disappearance of pain, cure of the ulcers and in some cases even reappearance of the peripheral circulation. Sénèque observes with justice that this operation is falling into disrepute even among those who were its most staunch protagonists. He believes that the operation is not founded on firm anatomopathological grounds and that it finds no warrant in clinical experience.

Henry Milch.

Padgett, Earl C., Kansas City. Free full-thickness skin transplantation. *J. Kansas Med. Soc.*, May, 1927, xxvii, 145.

The main advantages of the full thickness graft are: (1) Contraction is much less than following a Thiersch graft (a Thiersch graft does not give a satisfactory result in cases of marked deformity after burns); (2) in the palm of the hand, and other areas subjected to considerable trauma, full thickness grafts will give a good functional result if there is any soft tissue between graft and bone; (3) in certain congenital anomalies as in web fingers it offers a method giving a good result in one operation; (4) in certain disfiguring facial blemishes it has possibilities not possessed by other types of skin transplants.

If the bone is nearly bare or thickness is desired a flap transplant offers advantages not otherwise obtainable. The disadvantage of a flap is, first, that its thickness in certain areas gives a clumsy result less pleasing from the esthetic standpoint, and second, that several operations are required. The Wolfe graft can be transplanted usually in one or two operations. The flap transplant has its distinct indications and probably is more useful in the various phases of plastic surgery than the full thickness graft. The Thiersch graft has the advantage that it will grow in an unclean field. From the standpoint of appearance a full-thickness graft in successful cases is far superior to the Thiersch graft which is generally pale and white. The Wolfe graft in good "takes" appears, eventually, as normal skin.